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PROJECT SUPPORTING PAPER

RELATING TO

ROCKET LAUNCHERS

World War I thru World War II

(1917 - August 1945)

***

SMALL ARMS DIVISION

INDUSTRIAL SERVICE

ORDNANCE DEPARTMENT

DECLASSIFIED - DOD Directive No. 5200.9,
27 September 1958

Compiled by Annie J. Gregg
ANNIE J. GREGG

Reviewed by J. P. Aitchison
J. P. AITCHISON

24 February 1948

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ROCKET LAUNCHERS

PROJECT SUPPORTING PAPER

PART I

INTRODUCTION - World War I thru May 1942 - Development of the "Bazooka."

During World War I, the attention of Army Ordnance engineers was mainly occupied by methods of carrying on successful trench warfare. They found hand and rifle grenades effective weapons against machine gun nests and light fortifications. Little attempt was made at that time to produce an anti-tank weapon. Rockets and signal flares were in use as a means of conveying signals.

The disastrous lightning drive of the swift-moving German Panzer tanks across Poland, the Lowlands, and France, just prior to the involvement of the United States in World War II, emphasized the need for an effective anti-tank defensive weapon, as about the only defense was the French 75, which could penetrate Panzer armor but proved too unwieldy and slow against the newer and swifter types of tanks. There was a crying need for a defensive weapon for Infantry use powerful enough to knock out tanks yet light enough to be carried, aimed, and fired as easily as a rifle.

During the interim between World War I and World War II, U. S. Army Ordnance engineers carried on a certain amount of experimental work on rifle grenade launchers and, in addition, on firing grenades by means of machine guns or some other discharger to gain added velocity and penetrative

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power over the rifle grenade, but limited funds had discouraged extensive experimentation until the acuteness of the European situation gave added impetus to development along those lines.[1] Also, the idea of combining the functions of a grenade and a rocket intrigued Army Ordnance personnel.

When grenades are thrown, the blast of the explosive charge normally travels in all directions and causes general destruction. The explosive blast can be directed to a particular mark by the use of a gun barrel or some other discharger, but penetrative power is lacking except at short distances.

It was found the rifle grenade gained new power and tactical value by the incorporation of the explosive principle known variously as the shaped charge, the hollow charge, or the Munroe Principle in experiments carried on by Army Ordnance Department the latter part of 1940.

The experimental work on rifle grenades culminated in January 1941 in the standardization of the Grenade, Rifle, Special, M9, which incorporated the Mohaupt Principle which, in turn, was an adaptation of the Neuman or Munroe Principle of the shaped charge.

The development work on the M9 series, the construction, production, and design were considered of such a secret nature that Ordnance Committee ordered that neither practice nor explosive grenades of this type could be used in time of peace, all contracts were subject to secret negotiation, and publication of hand books, instruction books or other publications concerning such grenades were expressly forbidden.[2] It was ascertained that at

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1. A detailed account of rifle grenade and grenade launcher development will be found in "Project Supporting Paper Relative to Grenade Launchers," Part III, 1919 thru 1941.
2. OCM Item 16374, Dec 30, 1940, approved OCM Item 16392, Jan 14, 1941.

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least three explosive manufacturers had the materials and were prepared to produce the necessary explosive for these grenades, without interference with other production of explosives, which assured the practicality of mass production when and if desired by Ordnance Department.

There remained the military problem, however, of how to get the explosive against the steel to be penetrated when that steel was incorporated into a rapidly moving tank.

The M9A1 grenade[1] (modified M9) could penetrate 1.25 inches of case-hardened armor and was effective and at short ranges trained troops were enabled to strike those spots on a tank where the blast could damage or destroy the tank. The grenade could be fired by using a launching device clamped to the muzzle of the M1903 or the M1917 rifle, having a central hole which permitted the firing of standard ammunition while the launcher was in place. The grenade was launched by a special blank cartridge.

Since the velocity of the grenade was only about 170 feet per second the penetration of armor did not result from the velocity of the projectile but was achieved entirely by the explosion of the shaped charge. When the thin-walled steel cone at the front of the shaped charge focused the detonation wave against a small area of a tank's armor plate the metal of the armor was raised to incadescence and the charge both burned and blasted a hole through it. The molten metal burst out at the rear in a cone-shaped spray of white-hot particles which killed or wounded crewmen and exploded any ammunition with which they came in contact. The hole blasted by the shaped charge could disable an armored vehicle by destroying vital parts, but most of the resultant damage was from injuries to crewmen, explosion of the tank's ammunition, or fire started by the hot metal spray.

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1. TM 9-294, 2 June 1944, Change 1

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While the M9A1 anti-tank rifle grenade increased the defensive power of infantry it fell far short of meeting requirements because the newer types of tanks had armor thicker than 1.25 inches, and, consequently, were not pierceable by such a grenade. A heavier grenade was indicated which, in turn, called for a heavier launcher than was possible for use with a rifle.

In the winter of 1941, almost concurrent with the entry of the United States as an active participant in World War II, such a grenade, to be fired from the heavy barrel M2 caliber .50 machine gun,(then the standard weapon for infantry battalions) was, after extensive tests, standardized as Grenade, H.E., M10. That design also incorporated the Mohaupt Principle. The M10 grenade could penetrate two inches of armor plate.[1] At the same time Grenade, Practice, M13 was standardized to afford a practice grenade simulating the H.E. M10 type. Information concerning the existence of those grenades was divulged to interested using services, but all details of construction, including methods of loading, operation, etc. was classified as confidential and not to be divulged except to the extent necessary in production. Limited quantities, under strict check, were issued to service boards for testing, etc.

Demonstrations and tests conducted with the M10 grenade convinced Ordnance that a quantity of those grenades with means of projecting them should be available in every rifle platoon. However, difficulties concerning the projector to be used was a matter of concern. An unexpectedly heavy recoil from the discharge of this heavier grenade seriously damaged the caliber .50 machine gun launching it. Suggested projectors included caliber

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1. OCM Item 17439, Nov 14, 1941; standardized by OCM Item 17513, Nov 28,1941 OCM Item 17589, Dec 30, 1941.

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.50 machine guns with bipod and shoulder rest; Boys caliber .55 anti-tank rifles; and caliber .60 anti-tank rifles (a development project then under way.) All of those types failed under test because of excessive recoil. The development of the caliber .50 grenade launcher required a slight modification of the machine gun barrel to secure the launcher. In order to overcome that problem, three approaches were undertaken: (1) use of a launcher requiring no barrel modification; (2) a special type of barrel; (3) a special launcher for the M10 and M16 grenades having a barrel approximately 16 inches long.[1]

While development work was being conducted on launching the M10 grenade by use of the caliber .50machine gun, that machine gun was withdrawn from infantry battalions and replaced by the 37-MM Anti-tank Gun M3. However, that did not terminate the need for the M10 grenade, of which 720,000 were under procurement.

Efforts to obtain a satisfactory launcher were speeded up, the desirability of using a shoulder weapon for greater ranges becoming more ane more apparent. It was felt that rocket projection from a device of sufficient lightness to permit its being employed as a shoulder weapon was the logical answer to the problem.

Technically and tactically, rifle launching was highly desirable because of the increase in fire power by an infantry group by making any rifleman a rocket man. Also, it would simplify training since the infranoryman would not have to learn to use a new weapon.

In an early experiment for rifle launching, the rocket grenade was suspended from the fixed bayonet and the propellent sticks were ignited by diverting some of the exhaust gases downward from the muzzle and into the motor----

1. OCM Item 17849, Feb 6, 1942; approved OCM Item 17889, Mar 5, 1942; also see O.O. 471.61/110

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tube through the nozzle. With this method the only recoil on the rifle was that due to the firing of the cartridge. This recoil, however, made the rocket very inaccurate. The lag between the firing of the cartridge and the ignition of the propellent gave time for the recoil to lift the rifle an unpredictable distance before the rocket left the bayonet. Dispersion was further increased because the short bayonet did not keep the rocket on course until it had speed enough to be established by its fins.

In addition, rifle launching of the rocket caused a back-blast which might seriously burn the firer, militating against its practicability. To produce initial rocket velocity while protecting the gunner two similar experiments were made with a bullet-projected rocket. One fitted a brass slug between the rocket motor and the rocket head so the rocket was mounted directly in front of the muzzle of the rifle; the other placed a brass slug at the rear of the rocket motor. An extensive series of tests were conducted in October - November 1941 along those lines, with indications of success. However, the dead weight of the slug and the cumbersomeness of the whole method militated against rifle launching for rockets.

After the failure of bayonet launching, Ordnance Department undertook development of a nine-round automatic launcher, using a square metal box containing nine overhead launching rails in three rows of three rails each. The dispersion was still too great and the method undependable so that experiment was dropped as were all rifle rocket launching experiments, in favor of tubular launchers.

Because the elimination of recoil made a shoulder type of rocket launcher tactically and technically highly desirable, efforts were redoubled

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to develop such a weapon after the appointment of a Special Projects Unit of the Office, Chief of Ordnance, in March 1942.

In the meantime, a group consisting of representatives of Army Ordnance Department and the National Defense Research Committee had been working at the Navy Firing Ground, Indianhead, Maryland, developing a series of experimental rockets. Industrial Division of the Ordnance Department, in their efforts to obtain the type of launcher desired, encouraged the Indianhead group to adapt the M10 grenade for rocket propulsion, thus combining the idea of the shaped charge grenade and the rocket principle for practical demonstration.

This revolutionary step in the development of a new infrantry weapon was accomplished by apparently simple alterations. The hollow stabilizer tube was converted into a rocket motor by inserting five sticks of propellent powder, by holding them in place at the rear of the tube with a pipe and wire web, called a trap, and by attaching a restricting nozzle at the open end of the tube to increase the pressure of the combustion gases and to direct their flow. That apparently simple conversion, however, was not completed until many technical and tactical problems had been solved.

In the course of Ordnance Department's development program after tubular launchers were used it had been found that the addition of a nozzle and powder trap at the rear of the motor tube had so shifted the center of gravity backward that the shrouding fin of the M10 grenade would not give a stable flight. Therefore, the M13 practice grenades which were converted for rocket propulsion and tube launching were fitted with blade fins. Those fins were made with a larger diameter than the head, and a corrugated launching tube was designed and built to accommodate the rocket, eventuating in a 12-corrugation

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tube. Upon test, it was found the corrugated tube was too light, so that it bent if accidentally dropped and its construction was too complicated for ready mass production. It was replaced by a smooth tube and rocket fins were reduced to the diameter of the head. To gain stability they were at first made about 10 inches long, and on successive firings were shortened until the rocket became visibly unstable. In that empiracal way the proper length for the fins was determined. The launching tube, unlike the rifle, had no means of combustion ignition, which suggested the desirability of using an electrical ignition.

By May 1942, the outcome of the combined efforts of the Special Project Unit and of the Indianhead group, while promising, had still failed to obtain exactly the results desired, and the need of such a weapon was pressing. At that time, five days' notice was given of a demonstration at Aberdeen Proving Ground, upon the outcome of which the continuation of the project would depend.[1] It was ordered that a launcher, together with ten rockets, should be in readiness for that demostration, although at the moment not a single launcher fitted for shoulder firing had been completed nor a single rocket, incorporating the latest proposed improvements, loaded.

However, by the fourth day, all was in readiness and on that day a preliminary firing from the shoulder accomplished. The next morning, when the formal demonstration took place, the launcher's similarity in appearance to the comedian Bob Burns' well-known bazooka caused the colonel who fired nine of the rockets to dub it the "bazooka". The title caught on, replacing the correct name of the weapon except where technical correctness of monenclature was essential.[2]

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1. Verbal request from Brig. Gen G. M. Barnes, later Chief of Ordnance, Research & Development Service, as related by Major H. G. Jones, Chief of Rocket and Launcher Branch, in an interview.
2. See "Birth of the Bazooka", by Col. L.A. Skinner, Army Ordnance, Vol XXVII, No. 146, Sep-Oct 1944; also U.S. Rocket, Ordnance, Development and use in World War II - Office of Scientific Research & Development

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The next week another demonstration was ordered, to be held at Camp Simms, District of Columbia, for the benefit of high Army personnel and a restricted group of visitors, including representatives of allied powers. Upon arrival at Camp Simms, the engineers in charge of the "bazooka" demonstration found they were to fire in competition with riflemen firing M9A1 grenades. Theretofore no firing at a target had been undertaken; hence the rocket launcher was not equipped with sights. With only half an hour to meet that contingency, a crude peep sight of wire was fashioned and used. The handmade T1 rocket launcher, with its crude sight, was still so successful in its score that the Chief of Staff and other high military personnel were most favorably impressed with its effectiveness. Verbal authorization was given by General Marshall for the immediate manufacture of 5,000 launchers with an appropriate supply of rockets therefor, to be shipped as soon as available to strategic points of the active theatres of war. The launcher was standardized as Launcher, Rocket, A.T., M1.[1]

The new secret weapon proved a powerful addition to infantry armament. Rockets launched therefrom penetrated more than 3 inches of homogeneous steel armor plate at angles of impact as great as 30° from normal and retained full penetrative power up to their maximum range of 650 yards. On masonry, caat steel, such as girders and railroad rails, and timber their effect was unbelievably destructive, and wherever used, the "bazooka" spread consternation among the enemy.

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1. OCM Item 18421, June 30, 1942; approved OCM Item 18594, July 29, 1942.

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PART II

LAUNCHER, ROCKET, AT, T1

The Russian military staff, who had been among the witnesses of the "bazooka" demonstration at Fort Simms, requested they be supplied immediately with the rocket launchers even though development was still in progress. Therefore, the Chief of Staff issued verbal orders that 5,000 of the rocket launchers, along with necessary quantities of rockets and practice rockets, be immediately procured, to be delivered within a month, for Lease-Lend purposes, a limited number only of the rockets and launchers to be retained by Ordnance Department for further tests.

General Electric Company's plant at Bridgeport, Connecticut, had participated in the development of both the M10 anti-tank grenade and the rocket launcher and were in a position to proceed immediately with production. The Rocket, AT, T1, Rocket, AT, Practice, T2, and Launcher, Rocket, AT, T1 were recommended for adoption as standard for limited procurement,[1] and, on May 20, 1942, General Electric Company was notified they would be expected to manufacture 5,000 T1 rocket launchers as quickly as possible.[2] In the meantime, Ordnance Department was to continue development work on the rockets and launcher to provide for percussion firing instead of electric, to improve fins on the rockets, and to make any other modifications found advisable. Some 14 different model launchers were constructed before mass production was approved by Ordnance Department.[3]

The rapidity with which General Electric Company got production under way on this new weapon is evidenced by the fact that on June 16, 1942, when an Ordnance Department representative visited the General Electric plant

1. OCM Item 18246, 20 May 1942.
2. Letter Purchase Order W-478-ORD-1862; O.O. 475.71/3495, May 1, 1942.
3. "Production Chronology of General Electric Company." (Appendix D-2)

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he found the necessary material had been procured, plan for production had been completed, many of the components had been manufactured, and they were that day commencing final assembly of production quantities of rocket launchers. In spite of many minor and some major difficulties, General Electric Company succeeded in completing the manufacture and received the approval by the government inspectors of the 5,000 rocket launcher at 10:24 A.M. on June 24, thereby accomplishing a feat of production seldom equalled even in war time, and for which they received the commendation of Ordnance Department.[1]

British observers at the trial of the T1 Rocket Launcher held at Fort Simms were equally interested in this anti-tank weapon, and immediately began negotiations for a number of sample launchers. Upon the completion and shipment of the original 5,000 launchers,[2] negotiations got under way for the placement of a supplement to the original Letter Purchase Order, covering an additional 15,000, to be completed by August 1942.[3] To facilitate quantity production, Ordnance Committee took action to standardize the weapon as "Launcher, Rocket, AT, M1.[4]

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1. Memo, Production Sec. to Col Rene' R. Studler, Ex Officer, June 25, 1942.
2. O.O. 471.612/359, June 10, 1942.
3. Memo, Hand Arms & Equip Sec, Small Arms Br, Ind Div, to Production Planning & Control Br, June 30, 1942.
4. OCM Item 18421, June 30, 1942; approved, OCM Item 18594, Aug 6, 1942; O.O. 471.612/406, ltr to Springfield Ord Dist, Aug 17, 1942.

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LAUNCHER, ROCKET, AT, M1

The Army Supply Program of July 10, 1942, contained requirements for 75,000 rocket launchers, to be completed by December 31, 1942. General Electric Company was given additional schedules covering this procurement,[1] with instructions regarding certain design changes which were found advisable. The new schedule provided for production of 500 per day, even though General Electric Company had the capacity for 1,000 per day, because the raw material situation made it impossible to get sufficient priorities for more than 500 per day.

Because of revisions in design and difficulties in obtaining steel tubing, even with high priorities, General Electric Company requested[2] they be permitted to have no production in July, although scheduled. They expected to be able to produce 16,000 in August, 14,000 in September, October, and November, and 12,000 in December 1942, to supply the 75,000 on order. This schedule was accepted by Industrial Division, Office, Chief of Ordnance.[3] Upon receipt of orders for 1943 procurement, this schedule was changed to provide for 12,000 per month, September 1942 through February 1943, and 5,300 per month thereafter.[4]

In the meantime, because there were two launchers, the M1 Grenade Launcher and the M1 Rocket Launcher, there was considerable discussion as to the advisability of a change in nomenclature for the latter to "Gun, Launcher, Rocket, M1." Due to the wide geographic distribution immediately obtained, as fast as they could be produced, it was deemed best to retain the original designation of Launcher, Rocket, AT, M1.[5]

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1. O.O. 471.612/385, July 11, 1942.
2. O.O. 471.612/385, ltr to Gen Elec. Co.
3. O.O. 475.71/3495, Aug 12, 1942
4. TT 57844 240110Z Sep 1942; TT BSO WAO 15 121522Z Nov 1942.
5. Memo, Hand Arms & Equip Sec to Tech Div, Aug 17, 1942; 2d Memo Ind, Eng & Drafting Sec, Small Arms Br, to Artillery Div, 24 Sep 1942.

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Development work on the launcher having been carried on concurrently with the rush procurement, by the latter part of October 1942 it was found desirable to make changes in the sight dimensions and design, and Springfield Ordnance District was requested to authorize General Electric Company to incorporate the changes in production as rapidly as possible without affecting the authorized production rate, notification to be given of the serial number of the first launcher without the front handle and with the new sights in order that the using forces might be adequately advised of the change in type.[1]

A production schedule at General Electric Company for the first half of 1943 was approved in February 1943 as follows:

1943	
Jan	10,020
Feb	7,440
Mar	9,370
Apr thru Jun	8,060.[2]

GUNSLINGS

When the Rocket Launchers reached the field, it was found that gun slings were needed therefor. In February 1943, Chief of Ordnance was charged with the functions of procurement of Sling, Rocket Launcher, M2, that sling to be supplied for all launchers manufactured.[3] The nomenclature "M2" for that sling was found confusing, and shortly after the standardization of the Gunsling, its designation was changed to "Sling, Gun, Web, M1, with Accessories for Mounting on Launcher, Rocket, AT, M1."[4]

Commencing with Launcher, serial number 100,001, the slings were furnished as a part of the launcher. It was necessary to manufacture sling kits

1. O.O. 471.612/431, ltr to Spring. Ord Dist, Oct 16, 1942; Memo, Ord Inspector, Gen Elec Co, to Chief of Ordnance, Jan 8, 1943.
2. TT BSO 4 082220Z Feb 43, to Spring. Ord Dist.
3. OCM Items 19696, Feb 11, 1943, and 19849, Mar 4, 1943; O.O. 475.716/543(c).
4. OCM Item 20211, Apr 15, 1943.

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for the first 100,000, for attachment in the field.[1] Instructions were given Springfield Ordnance District for the procurement of 112,000 Gun Sling Kits for M1 Rocket Launchers, serial numbers 1 through 100,000, each kit to be accompanied by a printed instruction sheet, and in addition, the District was authorized to contract for the furnishing of gun slings for all rocket launchers above serial number 100,000, with 12 spare slings per 100 launchers.[2] In the field, especially in the Pacific Theatre, it was found the webbing and hardware suffered from mildew and rust, necessitating a change in the protective finish.[3]

MUZZLE DEFLECTOR

In order to protect the face of the soldier firing the M1 Rocket Launcher, especially under cold weather conditions, it was found necessary to provide a shield or "face guard" as it was termed in the beginning. Later that nomenclature was changed to "Deflector, Muzzle, for Launcher, Rocket, AT, M1" to avoid confusion in the field[4], and procurement of 25,000 of those deflectors on the current M1 Rocket Launcher contract with General Electric Company was authorized, on an urgent basis.[5] Additional requirements were later established for sufficient deflectors to provide for all prior production of rocket launchers[6], General Electric Company producing approximately 144,000 through November 1943.

1. Memo, H.R. Booth to R.S. Browne (both of Hand Arms & Equip Sec) Mar 5, 1943; Memo, Hand Arms & Equip Sec to FS Div, Maint Br, Mar 16, 1943.
2. O.O. 471/106, Apr 5, 1943.
3. Memo, Hand Arms & Equip Br to Rifle Br, Small Arms Div, Ind Sv, 23 Apr 1945
4. Memo Ind Div, Small Arms Br to Tech Div, Jan 28, 1943; 1st Memo Ind thereto, Tech Div to Ind Div, Small Arms Br, Feb 4, 1943.
5. O.O. 2002/BSA11, Apr 13, 1943, to Spring. Ord Dist; Memo, Hand Arms & Equip Sec to FS Div, Maint Br, Apr 16, 1943; Memo, Hand Arms & Equipment Sec to Tech Div, Apr 14, 1943; O.O. 471.94/188, Apr 19, 1943, to Spring Ord Dist O.O. 471.94/189, Apr 20, 1943, to Tank Automotive Center; O.O. 471.94/393, 21 Jun 1943, to Spring. Ord Dist
6. Memo for Record (Hand Arms & Equip Sec) 2 Sep 1943.

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MISCELLANEOUS PROBLEMS

By the latter part of 1942, reports from the field were coming in to the effect that difficulty in making contact between the launcher and the contacting band of rockets was being encountered. After various trials, it was found that by removing the shim plate and filing off the heads of the screws on the obturator plate, a correction could be made. Field Service Division was advised to notify all field stations, posts, etc. regarding proper procedure. Changes were made in curfent production to correct the trouble.[1]

Due to faulty ammunition and other causes it was found the life of the Ml Rocket Launcher was exceedingly low. By May 1943, the possibility of a greatly increased, unpredictable demand for replacements was becoming a source of concern.[2]

The Army Supply Program of February 1943 provided for production of 64,584 of the Ml Rocket Launchers in 1943 and 73,028 in 1944. Because it was economically unprofitable for General Electric to keep up its capacity on the schedule then authorized and in anticipation of greatly increased requirements at an early date, over-procurement of the Ml Rocket Launcher for 1943 was authorized.[3]

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1. Memo, Ind Div, Small Arms Br to Tech Div, Feb 19, 1943; Memo, Hand Arms & Equip Sec, to FS Div, Maint Br, Mar 15, 1943
2. Memo, Hand Arms & Equip Sec to FS Div, Maint Br, May 28, 1943

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3. Memo, Fiscal Unit, Adm Sec, Small Arms Br, Ind Div, to War Plans & Requirements Br, Gen O, May 15, 1943.

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LAUNCHER, ROCKET, AT, 2.36", M1A1

Technical Division had been working diligently, in conjunction with Industrial Division, Office, Chief of Ordnance, to eliminate the "bugs" which had developed when the M1 Rocket Launcher was submitted to actual service conditions, some of the more serious being several cases of premature bursting of the rocket motor tube, and occasional failures of the launcher itself. To provide adequate safety factors, a temporary suspension of production at General Electric Company was ordered. In July 1943, the wire-wrapped tube and certain changes in methods of ignition, eliminating the contactor box used on the M1 type of launchers, were incorporated into a modified weapon, and adopted as "Launcher, Rocket, AT, 2.36", M1A1."[1]

MODIFICATION KITS

The estimated production of modification components for launchers was delayed as some confusion arose in the beginning relative to exactly what type of wire would be used for wrapping the launchers, which made it impossible to make definite commitments for purchase of the wire. General Electric Company estimated they could produce modification components at the rate of 30,000 launchers per week, commencing within eight days after raw materials were made available.[2]

At the time modification was decided to be essential, 125,000 of the M1 Rocket Launchers had already been produced. The changeover entailed the scrapping of some parts in Field Service Stores and the ordering of a considerable number of new parts.[3]

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1. OCM Item 21203, dated 5 Aug 43, approved by OCM Item 21625, dated 23 Sep 1943; O.O. 471.94/319, 22 Jun 1943; Memo Small Arms Br, Ind Div to Tech Div, and 2d Ind thereto, 26 Jun 43, Small Arms Br, I nd Div to Tech Div; O.O. 471.94/753(c) , 25 Jun 45, Memo to Hq, ASF, Distribution Sec.
2. TT BSO B 126, 26 Jun 43, to Spring. Ord Dist; TT BSA B 31 281820Z Jun 43 to Spring. Ord Dist.
3. O.O. 471.94/328, 18 Jun 43; O.O. 471.94/319, 22 Jun 43; FS Work Order B36-#1 dated 1 Jul 1943.

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The entire resources of General Electric Company's rocket launcher production line was devoted to the modification program.[1] Urgency was established for necessary additional machine tools and raw materials[2], and, by 1 July 1943, General Electric Company had on hand enough raw material for one week's production of modification kits, and 90 per cent of the materials needed to accomplish the entire job. By July 7, the entire amount of raw material was on hand to modify the 125,000 launchers and reinitiate production of launchers. A schedule was set up as follows:

Week (1943)	Kits	Launchers
Jul 5	11,500	2,000 (probable)
12	28,000	2,000
19	28,000	2,000
26	28,000	2,000
Aug 2	29,500	2,000

Under such a schedule, the requirement for kits to modify 11,000 launchers by 10 July 1943 could easily be met, and it was contemplated that launchers of the new design would be produced at the rate of 2,000 per week until production be in line with scheduled requirements.[3]

The existing requirement for 112,000 gun sling kits was cancelled, and it was directed the kits already shipped be returned to General Electric Company at the cost of the government, where General Electric Company would disassembly, scrap unusable components, and set aside usable components to be applied against the new type of modification kits. The new modification kits were to contain necessary component parts to modify 25 launchers.[4]

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1. O.O. 160/G.E. Co. (6-25-43) R (W-478 ORD 2118)
2. Memo for Record, Hand Arms & Equip Sec, 3 Jul 1943.
3. O.O. 471.94/767 (c), 29 Jun 1943, to Tank-Automotive Center; Memo for Record (Burness), Hand Arms & Equip Sec, 3 Jul 1943; Memo, Hand Arms & Equip Sec to Eng Sec, Small Arms Br, 5 July 1943.
4. O.O. 160/Gen Elec Co (6-25-43) R, to Spring. Ord Dist, re contract W-478-ORD-2118 (Gen Elec) for M1 Rocket Launchers.
   Also see Field Service Modifi cation Work Order B36-W1.

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In a conference held in the office of the Chief of Industrial Division on 5 July 1943, Small Arms Branch was directed to have 280 boxes of modification equipment packed for air transport and 180 boxes for water transport, to be ready for delivery 10 July, shipping instructions to be issued by Field Service Division.[1] On 7 July, a representative of Small Arms Branch, Hand Arms & Equipment Section, personally carried 11,000 tags and 1,000 sheets of instructions to General Electric's Bridgeport plant, to make sure they were on hand as needed. He found that 40 kits were ready that day, and all raw material was on hand and available in finished form. The production line was expected to be in full operation by 9 July. A slight difficulty was being encountered in the size of box for the kits, wire wrapping necesitating a larger box than theretofore contemplated.[2]

By 14 August the modification program was completed by General Electric Company, within exactly six weeks from the time it was undertaken, the company thereby earning a letter of commendation from Major General L. H. Campbell Jr, Chief of Ordnance.[3]

FINAL PRODUCTION ON M1 ROCKET LAUNCHERS

On 26 June 1943, Springfield Ordnance District notified General Electric Company to stop production on the M1 Launcher.[4] On 30 July, the Resident Inspector at General Electric Company reported the total number of M1 units finally accepted was 94,460, but, of that number, 1,673 which were packed,

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1. Memo, Hand Arms & Equip Sec to FS Div, Maint Br, 5 Jul 1943; 1st Memo Ind, FS Div, Maint Br to Hand Arms & Equip Sec, 5 July 1943.
2. Travel Report D.G. Burnell to Bridgeport, Conn, 7 Jul 1943; also see O.O. 471.94/456, ltr to Spring. Ord Dist, 7 Jul 1943.
3. O.O. 471.94/1061 (R), 14 Aug 1943.
4. O.O. 471.94/564, 1st Ind; ltr to Spring Ord Dist, Subject: "Production Order S-5808, Spare Parts for M1A1 Rocket Launcher," 30 Aug 1943.

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ready for shipment, had been unpacked and modified to M1A1s, making the cumulative acceptance 93,388 M1 Rocket Launchers, as of 15 July 1943.[1]

As of 25 July 1943, beginning with Rocket Launcher serial 116, all units were shipped with muzzle deflectors as part of the launchers.[2]

MISCELLANEOUS PROBLEMS

Considerable difficulty was encountered in painting the Rocket Launcher M1A1. The paint would not readily adhere to the wire wrapping when O.D. Lusterless Paint was used. San Antonio Arsenal and Raritan Arsenal, after numerous experiments, respectively recommended the use of Primer Ground synthetic Gray, QM Spec ES No 360-A and Primer, Metal, Quick Drying, Spec No. 3-165A.[3]

The rush to get rocket launchers into the hands of overseas units resulted, by December 1943, in a decided shortage, necessitating the establishment of an immediate requirement for approximately 13,000 M1A1 Rocket Launchers to fill shortages in supply for task forces and divisional units. Between November 1942 and December 1943, practically all organizations which departed overseas were equipped with large quantities of rocket launchers, with the consequence that a surplus existed in the overseas theatres but that surplus could not be recovered in time to meet the pressing current demand at home. Authority was granted to over-procure the 1943 Army Supply Program requirements up to 5 per cent thereof, even though it might cause a short-fall in later months, with the proviso that obtaining such increased production should not delay putting the M9 Launcher into production, as already authorized.[4]

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1. Memo, Resident Inspector, Gen Elec, to COFORD, SPOIS, 30 Jul 1943
2. Memo, Ind Div, Adm Sec, to FS Div, Packing Sec, 3 Aug 1943; Memo, Ind Div, Small Arms Br to FS Div, Gen Sup Br, Group B, 5 Aug 1943.
3. Daily Activity Report, FS Div, 21 Aug, 1943; Daily Activities, Ord Rept 15 Sep 1943.

Hq, ASF, SPDDO 471.6, Memo f Director, Prod Div, HQ, ASG, dated 28 Dec 1943, Subject: Increased Production of Launcher Rocket, AT, 2.36 inch, M1A1; SPURR-3713, 1st Ind, Hq, ASF, Prod Div to Chief of Ordnance, 29 Dec 1943; TT to Spring. Ord Dist 29 Dec 1943; TT 29928 301450Z Dec 43, Spring Ord Dist to SPOIS promised 7,500 Launchers in Dec 1943 and 6,000 in Jan 1944.
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LAUNCHER, ROCKET, 2.36", M9

The M1A1 launcher design was short of adequately filling the need for a rocket launcher, especially for airborne troops (paratroopers). Ordnance Department was asked by the Commanding General, Airborne Command, to design a rocket launcher that could be taken apart and carried in two approximately equal lengths. Also, from the using services had come requests for better sights, provision of a safety switch, improved shape of a 2-position stock, and other changes and improvement in design. The T21E2 Rocket Launcher gave promise of accomplishing those objectives[1] but had not yet been approved for procurement by Industrial Service, OCO.

Under such conditions, Small Arms Branch, Industrial Division, was hesitant as to how to proceed relative to 1944 procurement, especially in view of the fact that Smaller War Plants Corporation was bringing pressure to bear to have the manufacture of rocket launchers assigned to smaller plants, that item being considered adapted to such manufacture.[2] An agreement was reached whereby orders for 3/8 of 1944 requirements instead of being placed with General Electric Company, was to be held open for two or three months to determine whether or not the design would become stablized and General Electric Company, which had been engaged in development as well as production, would no longer be needed in the program. By obtaining that delay in making a decision as to use of smaller war plants, the needed time for development of the new type launcher was gained. It was evident the

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1. OCM Item 21882, dated 21 Oct 1943.
2. Memo, Hand Arms & Equip Sec to Tech Div, 2 Jul 1943; Memo, Tech Div to Ind Div, Small Arms Br, 1st Ind, 16 Aug 1943; Memo, Hand Arms & Equip Sec, Small Arms Br to Adm Sec, Small Arms Br, re procurement of Full 1944 Requirements, 27 Aug 1943.

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change in model would require almost complete new tooling.

The wisdom of this delay in decision was justified when Smaller War Plants Corporation, after a thorough canvass of the situation, rejected the manufacture of the rocket launcher in smaller plants, leaving Ordnance Department free to contract with such facilities as it saw fit.[1]

The performance of the T21E2 Rocket Launcher, under exhaustive tests, was sufficiently satisfactory to justify its adoption as "Launcher, Rocket, 2.36", M9" in October 1943.[2] This two-piece rocket launcher presented new production problems, calling for new tooling, the scrapping of some components, etc.

The ASP requirements of September 1943 called for 26,000 Launcher, Rocket, M1A1. Immediate changes in requirements were issued, reducing the quantity of M1A1 Launchers to 3,000, the balance to be produced as M9s.[3] At the same time, authority was given for an additional quantity of 42,119, making a total of 65,119 of the M9 Launchers to be procured in 1944.

OPTICAL SIGHTING DEVICE

The M9 Rocket Launcher specifications provided the optical sighting device should be fabricated with an optical lens made from Calcite crystals.[4] Calcite proved to be such a critical and scarce item that the Navy Department made arrangements with the Office of Economic Warfare and Metal Reserve to obtain priority on all foreign and domestic supplies of Calcite, including the

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1. ~~Daily Activity~~ Ltr from Smaller War Plants Corporation to Small Arms Div, Ord Dept, 20 Oct 1943, re Production of Launcher Rocket M1A1 and M9; Ltr to Spring. Ord Dist, 2 Nov 1943, re Production Order S-5997.
2. OCM Item 21882, 21 Oct 1943, approved OCM Item 22331, 9 Dec 1943; O.O. 475.716/566(c); for prior development work see OCM Items 19597, 19666, 19766, 19859.
3. O.O. 400.12/49905, ltr to Spring. Ord Dist, 2 Nov 1943; TT 9019 022211Z Nov 43, to Springfield Ord Dist; Production Order S-5887, 2 Nov 1943.
4. OCM Item 19652, Feb 4 1943, approved OCM Item 19767, Feb.18 1943.

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output of Mexican properties which the Navy Department was exploiting. Navy Department was agreeable to supplying Ordnance after their own requirements were met, but the uncertainty regarding obtaining this component made it advisable to provide for an alternate sight until such time as an assured supply of Calcite crystals was available. Sight, Rocket Launcher, T43, a hinged bar with a front and rear sight, was devised, tested and adopted.[1] The difficulties regarding the sight effected a delay in the start of production at General Electric Company, making it impossible for them to meet the schedule originally set up for January 1944.

ELECTRICAL FIRING MECHANISM

Other complications arose in connection with subcontractors of General Electric Company who failed to live up to their commitments. Often it was like the tail wagging the dog; the production of the component became of more vital importance than the completed item, because General Electric Company, insofar as was humanly possible, fulfilled their contractual responsibilities. In December 1943, besides difficulties with the Magnavox Company, who at that time had all the responsibility for the trigger mechanism for the M9 Launcher, General Electric Company was confronted, among other complications, with the change-over to the hinged bar sight, and there were 12 items of raw materials which General Electric Company was having difficulty in obtaining, even on established priorities.[2]

~~xxxx OCM xItem x 21964, xFeb x 4, x 1943, xapproved x OCM x Item x 19859, xMar x 4 x 1943x~~

1. OCM 21964, 28 Oct 43; Memo, Hand Arms & Equip Sec to Prod Sv Br, Raw Materials Sec, 2 Nov 1943; Memo for Record, Hand Arms & Equip Sec, SUBJECT: "Conference on Optical Calcite", 12 Nov 1943; O.O. 471.94/1728(c) from Hq, ASF, Orod Div to COFORD, 1st Ind, 29 Nov 1943; Memo, Ind Div, Small Arms Br, to Tech Div, 13 Nov 1943, and 1st Memo Ind thereto from Tech Div to Small Arms Br, Ind Div, 15 Nov 1943; TT 27265 171655Z Nov 1943 from Spring. Ord Dist to COFORD, Attn: SPOIS; O.O. _____ ltr to Springfield Armory, 20 Nov 1943; Memo, Tech Div to Ind Div, Small Arms Br, 23 Nov 1943; O.O. 413.75/1078; ltr SPOIS to Navy Dept, Bureau of Ordnance, Optical Sec, 7 Dec 1943; O.O. 400.325/25563 Navy, Memo from Bureau of Ordnance, Navy Dept to COFORD, 15 Dec 1943;
2. Memo for Record, Small Arms Br, Hand Arms & Equip Sec, 1 Dec 1943.

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Furthermore, there arose a question of using powdered metal castings, instead of conventional methods; in an effort to get quick action the decision was made to proceed as originally planned, leaving the use of centrifugal and powdered metal castings to further experimentation on the part of Technical Division.[1] However, Technical Division, upon being so apprised, claimed that since the item had been standardized, they had no control over manufacturing methods, leaving final decision as to whether conventional or alternate methods should be used up to Industrial Division, so long as military characteristics were not involved.[2]

Magnavox Company, in spite of every urging and assistance, were unable to supply the needed electric contactors - 2,000 by 15 January 1944, and 6,500 a month thereafter. The best they could promise was possible production the first week in February of 1,000 with 5,000 for the month, and 6,500 a month thereafter.[3] The status of the Magnavox patents on the Electric Firing Device T-6 also was the source of considerable concern, along with other complications encountered there.[4]

The latter part of December, Magnavox Company advised they would be unable to produce the contacting mechanisms for the M9 Launcher, after all, due to the fact that Marine Corps had priority for the production of an identical or similar device. Upon contacting Marine Corps, Ordnance Department

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1. TT, SPOIS to Spring. Ord Dist, 6 Dec 1942; 2d Memo Ind, Ind Div, Small Arms Br, Hand Arms & Equip Sec, to Tech Div, 14 Dec 1943.
2. 3 Memo Ind, Tech Div to Hand Arms & Equip Sec, 15 Dec 1943.
3. TT 1015 062232Z Dec 43, Chgo Ord Dist to COFORD, in reply to TT WAO 042039Z Dec 43.
4. Memo, Mr. Brown to Maj Volberg, Chief, HandArms & Equip Sec, re M9 Rocket Launcher patents, 13 Dec 1943; Memo, Patent Sec, Legal Br to Ind Div, Small Arms Br, Legal Unit, 18 Dec 1943 and 2d Memo Ind, Hand Arms & Equip Sec to Legal Br, Patent Sec, 1 Jan 1944.

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found Marine Corps orders had called for delivery in August, September, and October but, as yet, they had received no deliveries. However, they were willing to go along with Ordnance Department and try to get items for both orders simultaneously.[1]

In an effort to get action, a reprsentative of Industrial Division visited the Magnavox Company plant the latter part of December 1943. Magnavox agreed that if the raw materials and subassemblies were made available, they could and would assembly 1,000 of the firing key mechanisms per day, and if all outstanding materials were on hand the first week in January, they could ship 2,000 mechanisms to General Electric in January as scheduled. All suppliers were contacted by telephone and promised deliveries. Magnavox called attention to possible delay in February if magnet deliveries were not speeded up, and work got under way immediately on the part of Ordnance Department in an effort to correct that situation.

BAR SIGHTS

Although the T43 type of sight had been authorized to replace the unobtainable optical ring sight for use on M9 Rocket Launchers,[3] it was found this horizontal bar sight showed appreciable inaccuracy in alignment and a vertical type of sight, the T76, was suggested by personnel of Technical Division (Major Byrd and Dr. Tuttle) and Small Arms Branch, Industrial Division took up the desirability of a change of design with General Electric Company, through Springfield Ordnance District, provided the change would in no way interfere with production of the M9 Launcher as scheduled. In the meantime, initial production of the M9 Launcher was to be with the double-hinged bar sight which folded horizontally against the launcher tube, instead

1. Memo for Record, Hand Arms & Equip Sec (Burnell) 20 Dec 1943)
2. Travel Report of D.G. Burnell to Magnabox Company, regarding Firing Mechanism, Rocket Launcher M9, Dec 20-21, 1943; Notice of Conference at General Electric Co on 17 Jan 1944, regarding electrical characteristics of bazooka generator, etc, dated 9 Jan 1944.
3. OCM Item 21964, dated 28 Oct 1943.

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of the vertical, single hinge type suggested, which had not reached the tool design stage nor been standardized so Industrial Division could authorize its procurement.[1] Shortly thereafter, the T43E1 Rocket Launcher Sight was adopted as substitute standard for the optical ring sight, and no further action was taken in regard to the T76 type sight.[2] General Electric Company, having carried on extensive development work on the sight and being familiar with its manufacturing ramifications, were given preference for producing the Sight, Bar, Horizontal Folding, for Launcher, Rocket, 2.36", M9[3].

ROCKET LAUNCHER M9 PRODUCTION PROBLEMS.

By concentrated effort - telephone, teletype, letter, and personal visits of Ordnance representatives, the situation at General Electric Company and its subcontractors[4] gave promise of getting mass production on the M9 Rocket Launcher under way by the latter part of January 1944. The greater part of the necessary tooling was completed or would be during the first week in

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1. O.O. 471.94/898, 3 Jan 1944; Memo for Small Arms Dev Br, Tech Div; Memo from Ind Div, Small Arms Br to Tech Div, 29 Dec 1943; ltr to Springfield Ord Dist 30 Dec 1943; Memo, Tech Div to Ind Div, Small Arms Br, 24 Dec 1943; Weekly Report - Rocket, Launcher, M9 (Gen Elec) Hand Arms & Equip Sec to Chief, Small Arms Br, 4 Jan 1944;
2. OCM Item 22673, 20 Jan 1944, approved OCM Item 23286, 23 Mar 1944.
3. Memo, Tech Div to Small Arms Br, Ind Div, 22 Jan 1944.
4. Memo Ind Div, Small Arms Br to Ex Br, Ind Div, 21 March 1944. (gives names and location of prime contractors and important subcontractors engaged in production of Rocket Launchers as follows:

Prime contractor, M9	Gen Electric Co.	Bridgeport, Conn.
Firing Key Mechanism	Magnavox Co.	Ft. Wayne, Ind
Tubing	Pittsburgh Steel Co	Pittsburgh, Pa.
Forging, Male Coupling	Atwater Mfg Co	Meriden, Conn.
Forging, Female Coupling	International Silver Co.	Meriden, Conn.
Machining of Parts	Harmonica Reed Co.	Philadelphia, Pa.
Centerless Grinding	(Bridgeport Centerless Grind Co, Bridgeport, Conn (Eastern Centerless Grinding Co Hartford, Conn.	
Sight Parts	(Doehler Die Casting Co. Chicago, Ill (Greeley & Harving Mfg Co., Bridgeport, Conn	
Slings	Sturgess Mfg Co	Utica, N. Y.

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January, approximately 78 per cent of raw materials were on hand, and there was assurance that Magnavox Company would have raw materials and subassemblies in time to assure delivery of 2,000 firing mechanisms to General Electric Company by 20 January 1944. Optimistic anticipation was for production of 1,500 of the M9 Launchers in January.[1] The failure of Magnavox Company to live up to their commitments, which in turn delayed General Electric Company, held up initial production somewhat.[2]

During February, 3,510 of the M9 Rocket Launchers were produced, despite difficulties occasioned by new, green help, and weaknesses such as the safety failure because of unsatisfactory results from brazing operations on the fabricated couplings, etc.[3] and General Electric Company had hopes of producing 8,000 Rocket Launchers in March, and 10,000 in April, with the possibility of an additional 3,000 in April if essential spare parts requirements were waived.[4] The waiver was granted, to be in effect 4 months.[5]

Very shortly, another crisis arose, when the American Steel & Wire Company indicated it would not be able to deliver promised steel, which would cause a shortage on the schedule as then established.[6] ASP requirements as of 1 February 1944 increased requirements for M9 Rocket Launchers by

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1. See Weekly Report (supra).
2. Memo Maj F. M. Volberg, Chief, Hand Arms & Equip Sec, to Brig Gen J.Kirk, Chief, Small Arms Div, Weekly Report No. 3, 19 Jan 1944; Travel Report, D. G. Burnell to Magnavox Co, 24 Jan. 1944; telephone conversation between Brig Gen Kirk, Chief, Small Arms Br, Ind Div, and Col Slazak, Chgo Ord Dist, 27 Jan 1944.
3. Memo, Small Arms Br, Ind Div, to Chief, Ind Div, 25 Mar 1944.
4. Ltr to Springfield Ord Dist, 5 Feb 1944, Subject: "Launcher, Rocket, 2.36", M9". Memo for Record, Hand Arms & Equip Sec (Burnell) 9 Mar 1944, Subject: "Extra Production during March and April, Rocket Launcher, M9"; and 1st Memo Ind, Small Arms Br, to Prod Sv Br, Ind Div, 9 March 1944.
5. Memo, FS Div, Maint Br, to Ind Div, Small Arms Br, 20 Mar 1944; Memo, Small Arms Br, Ind Div, to Chief, Ind Div, 25 Mar 1944.
6. Memo, Hand Arms & Equip Sec to Planning Unit, Sched Sec, Small Arms Br. Subject : "Request for Assistance, Steel, Launcher, Rocket, M9, General Electric Co, dated 5 Feb 1944.

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approximately 43,000 for 1944,[1] making it necessary to double the scheduled production at General Electric from 6,500 per month to 13,000 per month. General Electric Company was obtaining its supplies of seamless tubing from Pittsburgh Steel Company at 54,000 pounds per month. They were not in a position to step up deliveries to the needed 108,000 pounds per month, without a War Production Board directive for the additional 54,000 pounds. Sufficient tubing was on hand to carry on only until May 1944. General Electric Company contacted a number of manufacturers of seamless tubing but none of them had sufficient individual open capacity to accept an order for 54,000 pounds per month.[2] After a widespread canvass, Ohio Seamless Tube Company of Shelby, Ohio, Detroit Seamless Tube Company of Detroit, Michigan, and Michigan Seamless Tube Company of South Lyon, Michigan, agreed to join with Pittsburgh Tube Company in supplying the required seamless tubing, if they would be given necessary priorities. Because of the critical status of Rocket Launcher M9, at the direction of Army Service Forces, Ordnance Office was pushing General Electric Company for all-out production, so much so as to create the danger of cleaning out practically all inventory in the plant for March and April production. Bridgeport being in a Group II Labor Area, even a short stoppage in production would threaten a loss of trained personnel, making continuity of production highly essential. Consideration was given to permitting increased tolerances on the tubing, in hopes of securing greater quantities, but the likelihood of increasing the amount of scrap militated against that step.[3] Also, in view of the criticalness of the tubing situation, tests were undertaken to establish if the strength of the launcher would be adversely affected by lowering hardness limits.[4]

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1. See Requirements Table, Appendix "A"-1.
2. Memo, Hand Arms & Equip Sec to Plan & Sched Sec, 11 Mar 1944.
3. Memo, Hand Arms & Equip Sec to Plan & Prod Sec, 25 Mar 1944; ltr from General Elect Co to Small Arms Procurement (D.G. Burnell) 31 Mar 1944.
4. Memo, Hand Arms & Equip Sec to Tech Div, 14 Jun 1944.

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In February 1944, because of the difficulties incident to the change-over from the M1A1 to M9 production, it had been expected that with luck 7,000 of the M9 Rocket Launchers might be produced in March, 9,000 in April, 11,000 in May, with peak production of 13,000 in June 1944. As a result of an urgent request from Headquarters, ASF, received 8 March, for all the launchers possible in March and April, General Electric Company bettered its March estimate by over 1,000 launchers and exceeded the maximum scheduled rate of production in April two full months ahead of the schedule made up in February. [1]

The latter part of April 1944 Field Service Division called attention to the unfilled requirements existing for Rocket Launchers. At that time Hand Arms and Equipment Section, Small Arms Branch, Industrial Division made a recapitulation of the entire Rocket Launcher program, as follows:

ASP Requirements	Actual Production
1942	1942
65,111	67,428
1943	1943
96,601	98,284
1 Feb 1944 Changed from 72,616 to 115,845	
1945	
98,612	

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1944 Schedule vs. Actual Production

Schedule		Actual Production	
Jan	6,692	6,020	M1A1
		1,500	M9 (Not accepted, however, by Ordnance Inspectors, due to coupling failure)
Feb	3,725	981	M1A1 (final production)
		3,510	M9
Mar	7,000 (changed to) 8,000	8,930	M9

1. Weekly Report of Accomplishments and Difficulties, 1 May 1944.

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Schedule	Actual Production		
Apr 9,000 (Changed to) 13,000	8,930	M9	thru 24 Apr; expect to meet schedule
May 11,000 (Changed to) 13,000			
June thru Sep 13,000			
Oct 13,000 (Changed to) 10,000			
Nov 9,284 (Changed to) 5,254			
Dec 4,050. [1]			

Under the extreme pressure being applied by Springfield Ordnance District and Ordnance Office, the facility was expected to produce sufficient launchers to cover all high priority issues at an early date.

PACKAGING INSTRUCTIONS

Immediately upon the standardization of the M9 Launcher, steps were taken to assure that a packaging instruction manual for the subject item and essential extra parts was issued, as the M9 presented packaging problems not encountered on the M1 or M1A1 Rocket Launchers.[2]

In March 1944, Augusta Arsenal reported that a shipment of M1A1 Rocket Launchers which had been shipped from Raritan Arsenal to Camp Forest, Tennessee in September 1943, had been sent to the Arsenal for working over, due to being in bad condition after having laid in storage for a long period. The items were new and, for the most part, still packed in original factory shipping cases but when opened it was found that 100 out of the 451 launchers in the lot were badly rusted and the bores in very poor condition. In order to prevent the possibility of future repetition of the

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1. Memo, Hand Arms & Equip Sec to Chief, Small Arms Br, 25 Apr 1944.
2. Memo, Hand Arms & Equip Sec thru Eng Sec, Small Arms Br, Ind Div, to FS Div, Sup Br, Packaging Sec, 14 Dec 1943.

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conditions which brought about the damage to those weapons, the Ordnance Department's Packaging Section issued orders regarding the preparation of more stringent instructions to be included in the packaging instruction manual for M9 rocket launchers, thereby insuring that cleaning and greasing would be adequate.[1]

Further modification of the Packaging Instructions was required when the M18 and M20 Launchers were standardized.[2]

INSPECTION OF M9 ROCKET LAUNCHERS

The simplicity of construction of the M1A1 Launcher had necessitated no new inspection and maintenance technical manual upon its adoption as the standard rocket launcher. The M9 Rocket Launcher, due to its construction, was a different matter, presenting as it did problems of inspection, maintenance, and repair that could be solved only by higher maintenance echelons. Therefore a new Technical Manual, TM 9-294C was prepared.[3]

The principal differences in the two types were in the firing mechanism and the barrel coupling and lock. For the M9 type it was necessary to replace broken and worn firing mechanisms as a unit, the old ones being returned to the factory for repair. However, flash light testers for testing the magnets were to be supplied for use by the using arms as well as by regular Ordnance Maintenance personnel.

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1. Extract from "Inspection of Small Arms and Artillery Maintenance at Augusta Arsenal, Augusta, Georgia" 8 Mar 1944; Memo for Record, Hand Arms & Equip Sec; 1st Memo Ind, Hand Arms & Equip Sec to Chief, Small Arms Br, Ind Div, 1 Apr 1944.
2. Memo, Hand Arms & Equip Br to Eng & Insp Br, Attn: Mr. Tilton, 1 Dec 1944.
3. O.O. 300.7/1752, ltr from Raritan Ars to COFORD, 20 Apr 1944 and 1st Ind, 8 May 1944

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In a letter sent to Ordnance officers in overseas theatres it was requested that units equipped with the M9 Rocket Launcher, or doing maintenance work on that launcher, furnish experience data on the front barrel assembly C7311804, as such information regarding the condition of the barrel assembly after combat or training activity was needed to determine whether the front barrel assembly should be furnished as a spare part or a major overhaul.[1]

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1. Memo for Record (Booth, Hand Arms & Equipment Br, 20 May 1944, re Technical Information Letter No. 13, 29 Apr 1944.

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LAUNCHER, ROCKET, 2.36", M9A1

Even as the M9 Rocket Launcher production was just getting well under way, development work was being carried on to eliminate weaknesses which became manifest in mass production and under actual field conditions, notably in the fabricated coupling, which was not sufficiently strong to withstand dropping from shoulder height without undue distortion. Early in April it was recommended that the M9E1 Rocket Launcher be standardized as Launcher, Rocket, 2.36", M9A1, the M9 Rocket Launcher to become a limited standard item.[1]

To afford a ready distinction and identification between the M9 and the M9A1, it was decided that the serial numbers to 35,000 should be assigned to the M9 Launchers, production on M9A1 to start with serial number 35,001. It was expected that production on the M9 would actually be several thousand less than the 35,000 mark but because the M9 and the M9A1 would be being delivered concurrently, sufficient leeway was deemed essential to avoid any possibility of confusion later after the launchers were in the hands of the using services.[2]

Identification of the two types of the M9 series was especially important in view of the fact that the new method of fabricating the forged coupling components destroyed interchangeability between the launchers of early manufacture and those of new manufacture.[3]

DEFLECTOR FOR M9A1 LAUNCHER

The funnel-shaped deflector for protection against back flash used on the M9 Rocket Launcher was also incorporated in the M9A1 type.[4]

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1. OCM Item 23408, 6 Apr 1944, approved OCM Item 24075, 8 June 1944.
2. O.O. 471.1683, 1st Ind, to Spring. Ord Dist, 26 Apr 1944.
3. Memo, Hand Arms & Equip Sec to Tech Div, 25 Mar 1944; also see OCM Item 23408.
4. TM 9-294 and changes thereon.

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REPLACEMENT OF M1A1 BY M9A1 ROCKET LAUNCHER

At the time Ordnance Committee gave formal approval of Launcher, Rocket, 2.36", M9A1 as the standard rocket launcher, they also took action looking to a 100 per cent replacement of the M1A1 Rocket Launcher by the newly standardized weapon. That had been found advisable because repeated reports from overseas had indicated the short life of batteries, lack of batteries, inoperative condition of electrical system in wet weather, poor sighting equipment, and the difficulty of carrying the 54-inch tube through heavy growth made it entirely inadequate. That was especially true because under actual battle conditions, it had been found the "bazooka" was an advantageous offensive weapon as well as a defensive anti-tank weapon, and ease of carrying and of concealment had become distinctly important.[1] A particular disadvantage of the M1A1 Launcher was that its sight was such as to render high angle firing more or less a matter of guesswork, which handicapped the launcher's full exploitation as an infantry weapon.

ROCKET LAUNCHER M9A1 - PRODUCTION PROBLEMS

On 22 May 1944, an ASP requirement was established for the procurement of 215,177 of the M9A1 Rocket Launchers in 1944, and 158,562 in 1945, this being an increase in rocket launcher requirements of approximately 99,332 for 1944 and 60,000 for 1945.[2]

General Electric Company was contacted and they offered a possible schedule on an all-out basis, provided raw material could be obtained, as follows:

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1. OCM Item 24437, 20 Jul 1944, approved OCM Item 24700, 19 Oct 1944; O.O. 471.94/2043; Infrantry Board Reports Nos. 1518 and 1539.
2. See Table of Requirements - Appendix "A"-1.

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1944	Previous Schedule	Proposed Schedule	Proposed Increase
May	13,000	13,000	
Jun	13,000	13,000	
Jul	13,000	15,000	2,000
Aug	13,000	22,520	9,520
Sep	13,000	28,520	15,520
Oct	10,000	30,520	20,520
Nov	5,254	30,520	25,266
Dec	4,000	30,506	26,506
Total	84,254	183,586	99,332

Under that proposed schedule, it was contemplated the current contracts could be completed in September, with the delivery of 20,734 in that month. Such increased production was predicated upon a considerable increase in production of raw materials, purchased parts, and subcontracted components being available.[1]

General Electric Company had already stepped up their production lines for an output of 13,000 per month of the M9 Rocket Launchers, which was a marked increase over production first contemplated. The May requirements which necessitated a monthly schedule of 30,520 per month of the M1A1 Launchers meant that more than double the contracted production would be necessary.

Upon submitting General Electric Company's proposed schedule to Smaller War Plants Corporation, it was suggested the additional production might well be turned over to some of the smaller war plants. Ordnance Office was opposed to such action, in view of the fact that the rocket launcher was a weapon still under development - the M9 type having already undergone numerous changes in design during the short period it had been in production, and on the M9A1 Launcher there were additional possibilities of minor or even major changes,

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1. Memo, Hand Arms & Equip Sec, to SWPC Liaison, Subject: "Procurement Item Sheet 4334-SA for 178,613 Launchers, Rocker, 2.36", M9A1," dated 26 May 1944.

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and it was argued that General Electric Company, having participated actively in the development work on the M9A1 Launcher, was much better fitted to cope with future contingencies than a company which had had no experience in producing the rocket launcher. It was made clear that only in case it should be found that General Electric Company could not meet required deliveries would Ordnance Department be agreeable to contracting for additional sources. However, after a thorough survey of the situation, and taking into consideration the limitations on plant capacity and the tightness of the labor situation in Bridgeport, it seemed advisable to seek a second facility, in addition to classifying all necessary raw materials and components as "Emergency Urgent."[1]

The Chicago, New York, Cleveland, and Cincinnati Ordnance Districts, as well as the Springfield Ordnance District, were alerted to seek a second facility for the manufacture of M9A1 Rocket Launchers. In addition, the feasibility of contracting with such smaller plants as were suggested by Smaller War Plants Corporation Liaison was given serious study.[2]

The anticipated necessity of rapidly replacing the M1 and M1A1 Rocket Launchers in toto by M9A1 Rocket Launchers lent impetus to the search for a suitable second facility, because that step would increase the requirements materially.[3]

The outcome of the search for a new facility was the signing of a contract with Cheney Bigelow Wire Works, Springfield, Massachusetts, to manufacture

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1. Memo, Hand Arms & Equip Sec to Lt. Col W.W. Mohun, Adm Sec, Small Arms Br, Ind Div, 24 May 1944; TTS (Volberg, SPOIS) to New York and Chgo Ord Dists, 20 May 1944; O.O. 471.94/1938.
2. Memo, Hand Arms & Equip Sec, to SWPC Liaison, 26 May 1944; Memo for Record (Burnell) Hand Arms & Equip Sec, 31 May 1944.
3. Memo for Record (Volberg) Hand Arms & Equip Sec, Subject: "Change in Program for M9A1 Rocket Launcher" 2 June 1944; Memo for Record (Volberg) Hand Arms & Equip Sec, Subject: "Requirements for Launcher, Rocket M9A1 under Program to Replace all M1 and M1A1 Launchers" 27 Jun 1944; Memo, Ind Div, Small Arms Br, to Tech Div, 28 Jun 1944; TT WAO V GYO NR 53 WD 052010Z Jun 1944; Memo for Record - Investigation of Various Facilities - Report, 8 Jun 1944; Memo for Record, further reports, 12 Jun 1944.

M9A1 rocket launchers in accordance with current manufacture at General Electric Company. Greist Manufacturing Company, New Haven, Connecticut, was their subcontractor for supplying the generator.[1] Theretofore, Cheney Bigelow had been engaged, as a subcontractor, in the manufacture of machine gun mounts and recoil mechanism for the 33 MM Gun, and their tooling and equipment were such as to be readily adapted to rocket launcher production up to approximately 6,000 to 7,000 per month, with a possibility of future expansion to a maximum capacity of 15,000 per month.[2]

General Electric Company was scheduled to produce at the rate of 27,000 per month (a little more than double their original schedule) and Cheney Bigelow Wire Works at the rate of 6,600 per month, giving a total capacity of 33,600 per month during 1944, to meet the ASF requirements.

The latter part of July 1944, when the retirement of the older type of launchers was authorized by Ordnance Committee, it was estimated that in order to replace all existing M1 and M1A1 Rocket Launchers, the new requirement for 1944 would be 253,531. Based upon such requirement, and if the rates of production set at the two facilities could be maintained, all except 38,500 of the M1A1s could be replaced in 1944. Then, if instead of cutting production in January 1935 according to the then existing schedules, the higher production rate should be maintained, it would be possible to complete the replacement program in the first quarter of 1945. Adding a third facility was not favored because in determining upon the use of Cheney Bigelow Wire Works it had been found no other plant contacted was prepared to go into production without too much loss of time in tooling up, contracting

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1. Telephone converation between Lt. Sheldon, Spring. Ord Dist, and Capt. Bryden, Small Arms Br, Ind Div, 14 Jun 1944.
2. Memo for Record, re Cheney Bigelow, 12 Jun 1944; SOD 471.94/768, Spring. Ord Dist to COFORD, 30 Jun 1944.

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for materials, etc., and that by the time such third facility could be ready to go into quantity production the need therefor, under then existing requirements, would be past.[1]

Cheney Bigelow encountered an initial difficulty when setting up their machinery in securing spot welders and also they could not obtain seamless tubing, so had to use a welded tubing.[2]

The first five rocket launchers produced by Cheney Bigelow Wire Works were submitted to proof tests at Aberdeen Proving Ground on 18 September 1944, less than three months from the date of the award of contract.[3]

Cheney Bigelow Wire Works were notified they would be expected to meet their original October schedule and, in addition, make up the September deficit during October.[4] That Cheney Bigelow lived up to expectations is evidenced by a letter of commendation sent that company the middle of November, expressing satisfaction that the company had been able to accomplish its production objective, even though it had to overcome many difficulties to initiate production.[5]

Incidentally, the speed with which the M9A1 Launchers reached the troops overseas was evidenced by a photograph showing the action of Rocket Launcher M9A1 against a German tank in France sent in November 1944 to Cheney Bigelow as a morale builder for workers in their plant.[6]

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1. OCM Item 24437, dated 20 Jul 1944.
2. TT DuVall SAFHAS MH 1748Z 8 Jul 1944 and TT from SPOIS in reply thereto dated 12 Jul 1944; Memo for Record (Burnell) Hand Arms & Equip Sec, 18 Jul 1944; O.O. 471.94/2398 (SOD 471.94/814), 12 Jul 1944.
3. Weekly Report of Accomplishments and Difficulties, Small Arms Div to Ex Div, Gen O, 25 Sep 44.
4. TT from SPOIS to Spring. Ord Dist, 22 Sep 44.
5. Ltr (Burnell) Hand Arms & Equip Br to Cheney Bigelow Wire Works, 13 Nov 1944.
6. Ltr Small Arms & Equip Br to Cheney Bigelow Wire Works, 23 Nov 1944.

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T90 REFLECTING SIGHT

As heretofore discussed, the sight used on the M9 type of rocket launcher was unsatisfactory and development efforts had to be continued.

The Calcite crystals still being unobtainable, a new approach was made to the problem by the use of a plane disc-shaped ocular having a small reticle at its center opposed to a concave transparent mirror which partially reflected and partially transmitted light. By mounting this sight so it was capable of being substituted for the current bar sight with no modifications to the launcher or sight bracket, a superior sight, rugged enough to withstand field conditions, was attained and the replacement of the bar sights on the M9 and M9A1 Rocket Launchers already in the field by the T90 Reflecting Sight was recommended, regardless of the good or bad condition of the existing sights. That sight could not be used on the M1A1 Rocket Launcher to improve its sighting ability without a field modification of considerable magnitude, and the rapid withdrawal of that type of launcher from the field made it inadvisable to take any action along that line.[1]

The two facilities were notified to use the T90 Reflecting Sight on the M9A1 Rocket Launchers currently being produced.[2]

The Cystoscope Company had cooperated with Ordnance Office in the development of the new T90 Reflecting Sight.[3] That Company had two plants in New York City, one devoted to filling Navy requirements and the other to making boroscopes and cystoscopes. The Company was interested only in the manufacture of the sight element, including an aluminum casing, and not in sight containers or bracket attachments as required for a completed assembly.

1. OCM Item 25177, 21 Sep 44, approved OCM Item 25414, 12 Oct 44.
2. Ltr to Spring. Ord Dist, Subject: "Reflecting Sight D7161556 for M9A1 Rocket Launcher," 8 Oct 1944.
3. Memo for Record, 6 Sep 1944, Subject: "Optical Sights for Rocket Launcher, M9A1."

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Their available capacity was for 15,000 to 20,000 per month and, if desired, a step-up in production would make it possible within two or three months to turn out 1,000 per day, and within one or two months additional time to turn out 2,000 per day minimum. Ordnance Department estimated that production should be 2,000 per day minimum on an "Emergency Urgent" basis until approximately 200,000 sights had been produced, then could drop to 20,000 per month. Those figures were based upon the need for approximately 100,000 of the sights for replacements in the using theatres before the facilities could start using the new sight in current production.

To provide for the change of sights in the field, modification kits, consisting primarly of the reflecting sight, were to be produced on an "Emergency Urgent" basis.

Cystoscope Company contracted to supply the kits, and later the sights for new weapons, as a sub-contractor of General Electric Company and Greist Manufacturing Company, the latter being a sub-contractor of Cheney Bigelow Wire Works, one of the prime contractors for M9A1 rocket launchers.[1]

A manual covering the reflecting sight was prepared and instructions were issued that a copy should be packed with each sight assembly. A rush supply of the manual was sent to Springfield Ordnance District, to arrive by 5 February 1945, for inclusion in the first shipment of the replacement kits.[2]

After production got under way, it was found that the sight was not as completely waterproof as had been anticipated, and it was necessary to make certain modifications to attain proper waterproof characteristics.[3]

1. TT to New York Ord Dist from SPOIS (Burnell) 6 Sep 44; ltr to Spring. Ord Dist, Subject:" Reflecting Sight for M9A1", 21 Sep 1944; Memo for Record, Hand Arms & Equip Br to FS, Maint Div, 27 Sep 44; Memo, Hand Arms & Equip Br to Plan. and Sched Br, Subject: "Specto Photometer for the American Cystoscope Makers, Inc", 4 Dec 1944.
2. TT 31 Jan 1945, SPOIS to Spring. Ord Dist, re TB 9-294-4; Memo, Hand Arms & Equip Br to FS, Maint Div, 1 Feb 1945.
3. Ltr from American Cystoscope Makers, Inc, 5 Dec 1944; ltr to American Cystoscope Makers Inc, 8 Dec 1944.

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By early in January 1945, the rate of assembly was between 700 and 800 sights per day. It was estimated that 17,000 sights should be produced during January, and that by the end of that month assembly should be at the rate of 1,350 per day, if no further contingencies should arise. However, there was some question as to whether more than 5,000 would be manufactured.[1]

There arose considerable difference of opinion between various persons as to what constituted acceptable cleanliness and humidity tests of the reflecting sights.[2] A temporary expedient for moisture proofing was the use of "doughnut" type rubber washers of a different hardness from the washers then in use, while the redesign of the sight proper was being studied. 3 Chipping around the periphery of the lens and reticle distortion were sources of continuing rejections. Those differences caused the Cystoscope people to threaten stoppage of production on several occasions.[4] It was finally agreed to accept the chipped lens, where there was no optical interference arising therefrom.

TROPICALIZATION

The increasing use of the rocket launchers in tropical climates, such as the Southwest Pacific Theatre, brought about an urgent need for a study of better packing and preserving methods to prevent surface corrosion, fungus growth, and failure of magnets, with consequent weakening of the electrical firing mechanism.

1. NY ART 160/(19-059) (P BPW-D 13588G-1/10), ltr New York Ord Dist to Spring. Ord Dist, 10 Jan 1945, in reply to ltr from Spring. Ord Dist to New York Ord Dist, 30 Dec 1944.
2. O.O. 471.94/3937, ltr from New York Ord Dist to COFORD, 13 Jan 1945; TT SPOIS to Cystoscope Co, 19 Jan 1945; ltr from NY Ord Dist to American Cystoscope, 25 Jan 1945; Travel Report of H. Booth to NY Ord Dist and American Cystoscope Makers, Inc, 26 Jan 1945.
3. 1st Ind, O.O. 400.112/13805, 15 Mar 1945.
4. Ltr SPOIS to NY Ord Dist, 23 Feb 1945; O.O. 160/146591 G.E. Co, Spring. Ord Dist to COFORD, June 1945, and 1st Ind thereto 22 Jun 1945; Memo from RIO, American Cystoscope Makers, 27 Jun 1945; TT to NY Ord Dist, 2 Aug 1945, in reply to TT UGYO 41 281746Z Jul 1945.

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Investigation showed that magnets corroded easily. It was found the men, in an effort to remove the corrosion, were disassembling the firing mechanism, which resulted in marked loss in magnetism, to the detriment of the electrical output. The Magnavox Company, which had been the principal producer of electrical firing mechanisms, after trial, found that Almico magnets proved resistant to corrosion even under extremes of heat, rough handling and severe field conditions, and worked satisfactorily so long as they were not disassembled but that a heavy loss of magnetic field resulted upon disassembling, necessitating remagnetizing. Field Service issued strict instructions against disassembling, and as a further method of discouraging disassembly by making it more difficult, the heads of the screws were covered with solder.

Also, repeated complaints of considerable trouble with the trigger spring and of current leakage through the safety device came in from both European and Pacific Theatres. Industrial Service, OCO, protested against the type of safety in use, but was advised Ground Forces insisted on its retention.

Dirt and dampness, fostering the formation of fungus growth and corrosion, were the two chief offenders in all those operational troubles. To acquaint manufacturers as well as the using forces with preventive methods, Ordnance Department distributed widely to parties concerned copied of publications, specifications, and packaging instructions embodying the results of exhaustive tests in attaining protective finishes and tropicalization.[1]

1. "The Prevention of Deterioration of Material by Mold", Jan 1945; Ord Spec AXS-1311 "Varnish, Moisture and Fungus Resistant"; Spec JAN-C-76 "Cable (Hook-up wire) Electric, Insulated, Radio Instrument and Aircraft"; ltr SPOIS to Magnavox Co, 1 Nov 1944; ltr SPOIS to Magnovox Co, 23 Dec 1944; SA 400.27/122, Spring. Armory to Magnavox Corp, 19 Jan 1945; SA 400.27/123, Spring. Armory to Griest Mfg Co, 19 Jan 1945; Memo, Ex to Ch, Small Arms Div to Hand Arms & Equip Br, 26 Jan 1945 and Memo in reply 29 Jan 1945; Memo from Ch, Small Arms Div, thru Mil Plan & Trng Sv to Ch Mil Plans Div, Subject:"Report on Small Arms Materiel in ETO" 30 Jan 1945; ltr to Spring. Ord Dist, 5 Feb 1945, Subject, "Launcher, Rocket, M9A1" Memo, Hand Arms & Equip Br to FS, Main Div, 8 Feb 1945; Memo, Hand Arms & Equip Br to Res & Dev Sv, 9 Feb, 1945; ltr to Spring. Ord Dist, Subject:

1(cont) "Launcher, Rocket, M9A1, Tropicalization of", 1 Feb 1945; ltr to Spring. Ord Dist, 2 Feb 1945, ref: engineering changes to improve M9A1 Rocket Launcher; ltr to Cheney Bigelow 5 Feb 1945; 1st Ind, O.O. 471.94/44(SOD 471.94/1333) 10 Mar 1945; TT, SPOIS to Spring. Ord Dist, 17 Feb 1945.

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Greist Manufacturing Company, the subcontractor supplying Cheney Bigelow firing mechanisms, cooperated in every way in an effort to improve the moisture proofing of the "bazooka" generator. They tested out a solid armature which looked very promising, since rust between laminations and subsequent swelling had been the chief field complaint of causes for malfunctioning of the electrical firing mechanism assembly. Field Service sent representatives to the foreign theatres from whence had come complaints regarding moisture causing rocket launcher failures, carrying with them sample mechanisms with the solid slotted armature, and latest type of finish, to get combat-conditions tests.[1]

ELECTRICAL FIRING MECHANISMS

As subcontractor to Cheney Bigelow Wire Works, Greist Manufacturing Company had such difficulties as any new producer is apt to experience in manufacturing a functioning assembly developed by another company. General Electric Company was originally closely associated with Ordnance Department in all the development work on the M9 and the M9A1 Rocket Launchers and the Magnavox Company produced firing mechanisms for them. Cheney Bigelow came into the picture chiefly because General Electric Company was unable to produce the entire requirements under the accelerated rate called for by ASP requirements. In the hurry-up process, Greist was not at all times fully advised concerning requirements, and there was no Ordnance inspection except at the prime contractor's plant, while Cheney Bigelow exercised even stricter methods of checking than did the Ordnance inspector, in an effort to assure the acceptability of the finished launchers. In the beginning, over 50 per cent of the Greist generators were rejected and Cheney Bigelow discontinued their use temporarily, cancelling 20,000 with Greist Manufacturing Company and negotiating with Magnavox Company

1. Ltr to Greist Mfg Co, 23 Dec 1944; TT to Greist Mfg Co, 8 Feb 1945.

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for the needed generators. Magnavox Company proved none too cooperative with Cheney Bigelow, however.[1] In addition, Ordnance Department itself concentrated on obtaining a better type of generator.[2] By March 1945 Greist had succeeded in introducing sufficient corrective measures so as to be furnishing a much improved product.[3]

ELECTRIC FIRING MECHANISM TESTERS

The earlier types of rocket launchers had made use of batteries as the source of their electrical output for firing. The batteries had proved especially unsatisfactory because of the replacement problem. When the M9 Rocket Launcher was being developed, it was found that the Magnavox Company's mechanical firing mechanism was definitely superior because it eliminated the use of the battery, was not affected by temperature and extreme climatic conditions, and could be easily attached to the launchers in the field, being simple, compact, and in size no larger than the trigger grip it was designed to replace.[4] Assigned the nomenclature of "Mechanism, Electrical Firing, T6" that mechanism, under test conditions, proved its desirability[5] and it was incorporated as a component of the M9 Rocket Launcher.[6] There was no change in the electrical mechanism at the time the M9A1 Rocket Launcher became the standard rocket launcher.[7]

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1. Memo for Record (Booth) Hand Arms & Equip Br, 15 Feb 1945.
2. Memo, Hand Arms & Equip Br to Res & Dev Sv, 9 February 1945.
3. Memo, H. R. Booth to Lt. Col Volberg (both of Hand Arms & Equip Br) 2 Apr 45; Memo, Hand Arms & Equip Br to Chief, Small Arms Div, Subject: "Greist Mfg Co - Firing Mechanism for Launcher, Rocket, M9A1" commenting on visit of Mr. Fowler to Greist, 5 Apr 1945.
4. OCM Item 19800, 25 Feb 1943, approved OCM Item 19915, 11 Mar 1943.
5. OCM Item 20435, May 3, 1943.
6. OCM Iten 21882, par 2f(3).
7. OCM Item 23408, 5 Apr 1944, approved OCM Item 24075, 8 Jun 1944.

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Under field conditions, it was found that there were marked deviations in the performance of the electrical firing mechanism, and it was deemed advisable to supply some ready method of testing. The Magnavox Company was requested by service personnel to submit cost and delivery schedule on 50,000 electrical testing devices, as per sample inclosed, packed for export.[1] Ordnance Department authorized an initial procurement of 5,000 of the testers from Magnavox Company.[2] The Electric Firing Mechanism Tester (B7160977) was adopted for use with the M9 and M9A1 Rocket Launchers in August 1944.[3] It was estimated there would be a requirement of two testers per detachment equipped with rocket launchers, which created an immediate requirement for at least 50,000 testers.[4] Magnavox Company had contracted to produce 5,000 but had other commitments which prevented their undertaking that production on a scale sufficient to meet the requirement.[5] Therefore, contract was awarded to Motiograph Company for 45,000, and by December 1944, the latter company had set up three production lines and produced and had accepted by the government 10,200 testers, and expected to complete the 45,000 by 20 December 1944, but were in need of priorities for materials to continue production at the same rate, if any additional procurement were being contemplated.[6] Of the testers produced by 1 December 1944, 10,000 were turned over to Field Service Stores for early distribution.[7]

Further tests at Aberdeen Proving Ground disclosed that while the tester performed its specified functions, it was difficult to see the indicator light while testing the mechanism; also, it was easily lost or broken, and the methods

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1. Ltr to Magnavox Co, Ft Wayne, Ind, 6 May 1944.
2. Production Order S-6229; O.O. 471.94/2850, 29 Aug 1944, to Chgo Ord Dist.
3. OCM Item 24922, 31 Aug 1944, approved OCM Item 25477, 15 Oct 1944; O.O. 471.92/2411; O.O. 471.94/3061.
4. TT SPOIS to Chgo Ord Dist, 31 Oct 1944; O.O. 400.114/1551; Memo, Res & Dev Sv to Small Arms Div, 27 Nov 1944.
5. TT SPOIS to Chgo Ord Dist, 6 Nov 1944.
6. TT 167 ER 012203Z Dec 1944, Chgo Ord Dist to COFORD.
7. Memo, Hand Arms & Equip Br, to Res & Dev Sv, 12 Dec 1944.

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of attachment to the launcher were bad.[1] Similar complaints began to be received shortly after the first testers reached the field, which caused notice to be given Magnavox Company that the testers manufactured by Motiograph Company were unsatisfactory and a redesign would be necessary. In the meantime, production should be held up.[2] Also, the testers already produced were ordered scrapped.[3] Over a period of several months negotiations were carried on and conferences held, looking to resumption of production of the testers when an improved type had been approved.[4]

However, awaiting the development of an improved tester, the scrapping of the testers was held up, so as to ascertain whether or not the component parts might be utilized and production requirements be met by issuing an engineering change order on the existing contracts.[5] When the new tester was finally decided upon, it made use of a neon tube, which required a transformer and condenser; hence, few of the component parts from the Magnavox and Motiograph electric mechanism testers were re-usable. Under such conditions, it appeared inadvisable to keep frozen any longer the stocks of testers not previously disposed of, and Rock Island Ordnance Center was so advised.[6]

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1. O.O. 400.112/12817, 14 Dec 1944, and indorsements.
2. TT SPOIS to Chicago Ord Dist 2 Jan 1945; TT SPOIS to Magnavox Co, 2 Jan 1945; TT 327 022204Z Jan 1945, Chgo Ord Dist to SPOIS
3. TT SPOIS to Chgo Ord Dist, 15 Jan 1945; TT 71049 122050Z Feb 1945, Rock Island Ord Center to SPOIS, re TT 22066 2 Feb 1945 from SPOIS; TT SPOIS to RIA, 14 Feb 1945, re TT 71049.
4. TT 1490 MT 073156Z Feb 1945, Chgo Ord Dist to COFORD; O.O. 400.112/13894; TT SPOIS to Chgo Ord Dist, 7 Apr 1945; TT 1663 DH 093042Z Apr 1945, Chgo Ord Dist to COFORD.
5. Memo, Hand Arms & Equip Br to Res & Dev Sv, 10 Jul 1945.
6. 1st Memo Ind, 13 July 1945, Res & Dev Sv to Hand Arms & Equip Br; Memo, Rifle & Hand Arms Br to FS Suboffice, Rock Island Ord Center, thru FS, Maint Div, 6 Sep 1945.

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THERMO COUPLE TESTING METERS

Instead of the uncertainty of the field testers, the use of the Thermo Couple Testing Meters in the plants of the facilities by Ordnance inspectors was undertaken, ten of those meters being ordered in February 1945.[1] By June 1945, Thermo Couple Meters had been supplied to the facilities, interested sub-contractors, and to Dr. J. H. Bigelow of Columbia University, who was collaborating with Ordnance Department in working out better methods of testing rocket launchers.[2] Shortly thereafter, upon urgent request from an active theatre, five of the meters were turned over to Field Service, Maintenance Branch, for shipment overseas.[3] The latter part of July 1945, the purchase of 200 of the Thermo Couple Meters was authorized[4]. However, that order was cancelled, prior to any production thereon.[5]

OTHER PRODUCTION DIFFICULTIES ON M9A1 ROCKET LAUNCHER

Another difficulty which was reported from the field on the M9A1 Rocket Launchers was that the soldered bond between the electrical firing mechanism frame and the rear barrel from the ground connection was found to break loose very easily, causing a defective circuit.[6]

Complaints of mechanical difficulties and weaknesses of various sorts continued to come in from the field right on through the summer of 1945, the most serious of which concerned trigger breakage and rusting of trigger spring pickup.

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1. Memo for Record, Hand Arms & Equip Br, 13 Feb 1945, Subject: "Launcher, Rocket, M9A1, Insp Equipment"; Memo, Hand Arms & Equip Br to Fiscal Br, 15 Feb 1945; Production Order S-6384, 16 Feb 1945; TT 16 Feb 1945, SPOIS to Spring. Ord Dist; TT 16 Feb 1945, SPOIS to Dr. J. H. Bigelow, Columbia University; Travel Report, H. Booth to Gen Elec Co, 23 Mar 1945; Memo, 21 Feb 1945, Hand Arms & Equip Br to Res & Dev Sv, Travel Report, H.Booth to Gen Elec Co, 29 Mar 1945.
2. TT 66366 181838Z Jun 1945, Spring. Ord Dist to COFORD; Memo, Hand Arms & Equip to FS, Gen Sup, 6 Jul 1956; Memo for Record (Booth) Hand Arms & Equip Br, 19 Jul 1945;
3. Ltr to Spring. Ord Dist, Subject: "Launcher, Rocker, M9A1 - Thermo Couple Testing Meters", 27 Jun 1945.
4. Memo, FS, Maint Br, to Hand Arms & Equip Br, 28 Jul 1945; 1st Memo Ind ** Aug 1945; Memo, Rifle & Hand Arms Br to Fiscal Br, 20 Aug 1945; Memo FS, Maint Div to Rock Island Ord Center 24 Aug 1945; Memo, Rifle & Hand

(cntd) Arms Br to FS, Maint Div, 22 Aug 1945.
5. Ltr SPOIS to NYOD, 6 Nov 1945.
6. O.O. 471.94/3419; ltr to Spring. Ord Dist, 8 Nov 1944.

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M9A1 ROCKET LAUNCHER PROCUREMENT

Because of the various difficulties, some of which have been enumerated above, allocation of 62,235 rocket launcher requirements for 1945 had been held up until the first part of February 1945, at which time it was found feasible to instruct Springfield Ordnance District to proceed with the allocation, the schedule to be as follows:

1945	
May	8,303
Jun	12,000
Jul	7,000
Aug	8,416
Sep	10,000
Oct	10,000
Nov	5,516
Dec	1,000
Total	62,235

Instructions were to proceed as rapidly as possible, in order that raw materials might be ordered in time to maintain continuity of production.[1]

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1. Letter to Spring. Ord Dist, 10 Feb 1945

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LAUNCHER, ROCKET, 2.36-INCH, M18 (M9E2)

The weight of the M9 type of rocket launcher, even though it could be disassembled into two parts for transportation, was a matter of concern as the "bazooka" became more and more a weapon of offense rather than mainly defensive in nature, as was the case with the earlier models. To overcome the weight objection, the Launcher, Rocket, 2.36-inch, M9E2 was designed, using aluminum instead of steel in its construction, with only a few minor changes, such as a change in the stock and in the sight.[1] The M9A1 weighed 15.6 pounds whereas the M9E2 only weighed 10.3 pounds.[2] The aluminum type launcher withstood severe tests for strength and durability.[3] It was found, however, that the lighter weapon had a greater recoil, necessitating a rubber eye shield for use with Sight, Reflecting, T90.[4] The M9E2 launcher was adopted as the standard 2.36-inch rocket launcher, under the nomenclature of "Launcher, Rocket, 2.36 inch, M18 (M9E2)", to be substituted in production for the M9A1 rocket launcher as expeditiously as possible without in any way reducing the current rate of output of 2.36-inch rocket launchers, the M9A1 to become substitute standard.[5] The saving in weight afforded by the M18 launcher prompted Headquarters, Army Ground Forces, to request that the aluminum type be placed in immediate production with a view to completely replacing the M9A1 Rocket Launcher in the hands of troops in active Theatres of Operation, the M9A1 Launcher to be limited standard and production thereof to be terminated as soon as possible.[6]

1. Travel Report of Mr. H. R. Booth to Aberdeen Proving Ground, 25 Jan 1945; TT from SPOIS to Spring. Ord Dist, 30 Jan 1945; TT from SPOIS to Gen Elec 19 Jan 1945; TT SPOIS to Spring. Ord Dist, 29 Nov 1944, assigned AA-1 prior.
2. OCM Item 25894, 30 Nov 1944, approved for Required Type, Devel type OCM Item 26147, 21 Dec 1944.
3. 1st Ind, O.O. 400.112/11508 (APG 475.71/408) 24 Nov 1944.
4. Mem, Res & Dev Sv to Small Arms Dev Br, Ind Div, 16 Feb 1945; Memo, Res & Dev Sv to Small Arms Div, Ind Sv, Subj: "Launcher, Rocket, 2.36", M9E2, relative to eye shield and redesign of sight bracket, 23 Feb 1945; also see TT, SPOIS to Spring. Armory 3 Mar 1945 in reply to TT 39358 021116Z Mar 1945.
5. OCM Iten 26985, 15 Mar 1945, approved OCM Item 27463, 26 Apr 1945.
6. OCM Item 27497, 3 May 1945, approved OCM Item 27761, 23 May 1945; O.O. 471.94/5130, 4 Jun 1945; Memo, Res & Dev Sv to Small Arms Div,

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At the time the M18 Rocket Launcher was standardized, the General Electric Company, because of its part in developing the weapon, was selected as the facility to produce it. Estimates were obtained at to the cost of change-over from M9A1 to M18 production. General Electric's estimate was $60,000 for tooling (jigs, fixtures, etc) and $15,000 for production equipment, mostly heat treating and anodizing equipment. No estimate was obtained from Cheney Bigelow Wire Works because it was desired to hold that facility in production of the M9A1 Launcher until General Electric Company could get into production on the M18. Furthermore, Cheney Bigelow had been doing considerable development work on a 3.5-inch rocket launcher model, which Ordnance Department anticipated having ready for standardization within two to four months. The basic plan being followed at that time was to allow General Electric to be the source of aluminum 2.36-inch launchers amd Cheney Bigelow, while continuing production on the M9A1 Launcher, was to devote its efforts toward developing the larger rocket launcher. Small Arms Branch, Industrial Division, in agreeing to the change-over, stipulated the facilities should not exceed 100,000.[1]

Production order was issued 16 March 1945 for 28,517 Launcher, Rocket, M19, to be produced at the rate of 2,000 in August, 7,000 in September, October, and November, and 5,517 in December 1945, with the request that, if possible, the entire schedule be set forward one month. Priority of AA-1 was assigned.[2] Preparation of Packaging Instructions was also got under way.[3]

The new type stocks were not immediately available. Rather than set back anticipated deliveries of the M18 Rocket Launchers and having to

1. Memo, Lt Col F. M. Volberg (Chief, Hand Arms & Equip Br) to Chief, Small Arms Br, Ind Div, 20 Mar 1945; Travel Report, F. H. Fowlet to Gen Elec Co, Bridgeport, 22 Mar 1945.
2. TT, SPOIS to Spring. Ord Dist, 16 Mar 1945.
3. Memo, Hand Arms & Equip Br to FS, Main Div, Mil Pub Br, 19 May 1945.

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reinstate a portion of the M9A1 Launcher program, Research and Development Service suggested a limited number of Launchers, Rocket, 2.36-inch, M18 might be produced with the current type stock, with the proviso that as soon as available the new type stock be furnished to replace the old type on all M18 Rocket Launchers so equipped, the limited number of stocks to be kept to a minimum.[1] Industrial Service did not consider this feasible, and advised Research and Development Service to that effect.[2]

On the Production Order placed by Industrial Service with Springfield Ordnance District for 500 of the M9E2 Rocket Launchers, by 4 April 1945 there had been completed and turned over to Field Service 306 and it was expected 94 more would be produced by 7 April. The remaining 100, to be of alternative materials, were to be completed as soon as possible. By authority of OCM 26985, whereby the M9E2 was standardized as M18 Rocket Launcher and by the Army Supply Program, a Production Order was placed for 34,001 of the M18s, production to begin during July, provided the remaining details of design could be settled immediately.[3]

Upon checking the changes in the Army Supply Program proposed for VE-Day, it was found that a shutdown of all rocket launcher production would follow, with the consequent loss of the production facilities, as by 30 June 1945 (the expected V-E Day) all requirements for 1945 and 1946 would be completely met. That change would occur before any of the M18 Launchers could be produced, leaving only the substitute standard, M9A1, available,[4] and no further production on that model authorized.

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1. 1st Memo Ind, Res & Dev Sv to Small Arms Div, Ind Sv, 26 Mar 1945.
2. NOTE on Memo 26 March 1945.
3. Memo, Hand Arms & Equip Br to Eng Br, Small Arms Div, 10 May 1945
4. Memo, Small Arms Div, Ind Sv to Res & Dev Sv, 23 Apr 1945.

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In order to keep the facilities advised of the possibilities, the latter part of April 1945 Springfield Ordnance District was notified that Tentative Procurement Plans, based upon V-E Day being assumed to come 30 June 1945, for M9A1 and M18 Rocket Launchers, assumed that General Electric Company would have completed 89,000 rocket launchers up through 30 June 1945, and that Cheney Bigelow Wire Works would have completed 36,000 by that date, and the schedule for the first three months after V-E Day, both as originally planned in the February Planning Book and as revised in the April Planning Book, was outlined, with a view to advising the facilities what to expect, making allowance for the pending authorization of production of the 3.5-inch rocket launcher at Cheney Bigelow and the replacement of the M9A1 by the M18 2.36-inch rocket launcher.[1]

With the official declaration of V-E Day almost two months sooner than originally anticipated, all outstanding orders for the M9A1 Rocket Launcher at General Electric Company and Cheney Bigelow Wire Works were cancelled and production ceased.[2] Production on the M18 Rocket Launcher was also suspended and, while schedules were not definitely cancelled, no mass production was ever had on the aluminum type of 2.36-inch rocket launcher. As late as 6 August 1945, plans were still under way for production of the M18 Launcher, of which there were on order at General Electric Company a total of 34,000. It was estimated that schedule would be completed in December 1945, having been produced at the rate of 8,000 per month, and the 1946 requirement was for 12,714. Because of high production cost if strung out over the year, authority was being sought to have that number produced

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1. Ltr to Spring. Oct Dist, 27 April 1945, SUBJECT: "Advice to Prime Contractors as to Tentative Procurement Plans Following V-E Day."
2. Ltr, SPOIS to CG, Hq, ASF, Attn: Prod Div, 27 June 1945.

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in January and February 1946[1]. The only limiting factor on the production of M18 at that time (August 1945) was the procurement of firing mechanisms, and Magnavox Company had definitely promised delivery of from 2,000 to 3,000 mechanisms in time for assembly during August, in which case General Electric Company expected to be able to produce 2,000 of the M18 aluminum rocket launchers.[2]

The imminence of V-J Day, however, caused Small Arms Division, Industrial Service, to plan disposition of the Rocket Launcher equipment at Cheney Bigelow Wire Works and General Electric Company by the establishment of pilot lines at Springfield Armory. Subsequently, technical responsibility for the "bazooka" was shifted to Rock Island Arsenal. Because of the status of the M18 and the M20 Rocket Launchers, especially electrical problem difficulties, and the uncertainty of the effect of V-J Day plans on the rocket launcher program, there was some delay in the transfer of responsibility and the issuance of instructions regarding disposition of tooling and equipment on hand at the two facilities.[3]

Instructions from Headquarters, Army Service Forces, effective on 4 May 1945, for procurement purposes provided for the termination of rocket launcher production.[4] The termination date of 15 May 1945 left Field Service with a limited supply of spare parts, as spare part procurement of M9 and M9A1 essential spare parts while provided for[5] had been held to a minimum.

1. Memo, Hand Arms & Equip Br to Adm Br, Small Arms Div, 6 Aug 1945.
2. TT 68691 PC 071242Z Aug 1945, Spring. Ord Dist to COFORD, Attn: SPOIS
3. Memo, Rifle & Hand Arms Br, to Chief, Small Arms Div, 11 Aug 1945; RECORD PURPOSES ONLY, H.M. Smith to Panel on Disposition of Manufacturing Aids Committee, 13 Sep 1945; Memo, Rifle & Hand Arms Br to Eng Br 13 Sep 1945.
4. Instructions for Implementing MPR 20-ORDOX, 4 May 1945.
5. Memo, Hand Arms & Equip Section, Small Arms Br, 7 Feb 1944.

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and it was necessary to provide for end-buy quantities of spare parts for the M9A1 Rocket Launcher.[1]

DIFFICULTIES ENCOUNTERED IN THE FIELD WITH M18 ROCKET LAUNCHERS

Service tests of the M18 Rocket Launchers produced under limited procurement for such purposes, demenstrated that the same troubles encountered on the M9A1 launcher relative to rusting of the spring, etc. occurred with the M18. Therefore, in general, a recommendation was made that the spring be inclosed so as to prevent the collection of moisture with resultant rust. Request was made that General Electric Company undertake the development of a bellows type rubber boot to protect the trigger spring and also take steps to insure a protective surface finish to prevent rusting.[2] In July 1945, an order was issued that on all future production the Mechanism, Electrical Firing Group Assembly must be tropicalized.[3]

PRODUCTION PROBLEMS ON M18 ROCKET LAUNCHERS

It had been contemplated that production on the M18 would get under way during July 1945, and 2,000 were scheduled for production during that month. However, the requirement for tropicalizing the firing key mechanism necessitated re-tooling at Magnavox Company, and they could not supply the firing key mechanisms in time to permit General Electric Company to assemble the complete launcher. A new schedule of a minimum of 2,000 with a hoped-for maximum of 8,000 of the M18 Launchers in August 1945 was given the facility. On 6 August, Ordnance Office contacted Springfield Ordnance District General Electric Company and Magnavox Company, to be informed that Magnavox

1. TT SPOIS to RIA, 16 Mar 1945, requesting OSC study for spare parts showing end-buy quantity; Memo, Hand Arms & Equip Br, Ind Sv, to FS, 8 May, 1945, Subject: "Spare Parts for Pauncher, Rocket, M9A1"; Memo, Hand Arms & Equip Br. to FS, 14 May 1945, same subject.
2. Ltr SPOIS to Springfield Ord Dist, 19 Jul 45
3. TT SPOIS to RIA, re M18 Launcher, 28 Jul 1945.

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expected to have all necessary materials for the firing key mechanism in their plant by 8 August and initial shipments should start 15 August, between 5,000 and 6,000 mechanisms to be shipped during the month. General Electric Company reported they had on hand between 5,000 and 6,000 pairs of barrels ready for assembly, and if the firing mechanisms were delivered as promised, they expected to start up their assembly line on 20 August 1945.[1]

Due to V-J Day, however, the requirements for M18 Rocket Launchers were cancelled a few days thereafter, and no quantity production was had.

DESCRIPTION OF MANUFACTURE FOR LAUNCHER, ROCKET, M18

The plan to allocate the preparation of a Description of Manufacture for Launcher, Rocket, M18 the 1st week in August, the time when it had been expected tooling and assembly operations would be complete, was postponed because of the delays outlined above and shortly after V-J Day, its preparation was ordered discontinued. The tooling was ordered to be preserved and a description of pperation obtained in the use of tooling, both to be packed and shipped to the proper arsenal.[2]

OVERHAUL OF ROCKET LAUNCHERS

With the end of fighting in Europe, there arose the problem of overhauling some 42,000 Rocket Launchers of different models which had been in use there. It was anticipated the flow would start about the middle of August and be intermittent. At first, it was contemplated assigning this overhaul work to Cheney Bigelow Wire Works, but the unpredictable schedule of the launchers' availability made it preferable to assign the overhaul to Springfield Armory.[3] Later, when technical responsibility was transferred to Rock Island Arsenal, that Arsenal took on the overhaul program.

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1. Memo for Record, Small Arms Div, Ind Sv, 6 Aug 1945
2. Memo, Rifle & H.A. Br to Fiscal Br, thru Planning & Sched Br, 28 Aug 1945
3. Ltr from SPOIS to Spring. Ord Dist, 12 Jun 1945.

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tr to Spring Ord Dist, 27 Jul 1945; ltr to Spring. Armory, 27 Jul 1945; TT 42893 021918Z Aug 45
rom Spring. Armory; TT in reply thereto 3 Aug 1945; O.O. 471.94/146; O.O. 400.112/789, 31 Jul 1945.

LAUNCHER, ROCKET, 3.3-INCH, T74 (M20)

The need for a launcher for the new 3.5-inch rocket[1] which could be fired from the shoulder had manifested itself even while the M9A1 (modification of M9) 2.36-inch Rocket Launcher was being perfected, and in October 1944, authorization to proceed with such a development program was granted.[2] To the Ordnance Department's efforts to develop such a rocket launcher, Cheney Bigelow Wire Works lent every possible aid. Although engaged in the manufacture of the 2.36-inch M9A1 Rocket Launcher, the laboratories of that company devoted considerable time to evolving the larger rocket launcher. Early in 1945, the joint efforts of Ordnance Department and Cheney-Bigelow produced a model which was considered sufficiently promising to justify the procurement from Cheney Bigelow Wire Works of 100 additional Launcher, Rocket, 3.5-inch, T74, to be manufactured by production methods, delivery to be on or before 1 June 1945.[3] By the latter part of June 1945, ten of the T74 Rocket Launchers had been completed, part of which had component members fastened to the barrel pieces with screws and part of which utilized welding as a means of fastening adjacent components. A description of manufacture also was prepared. Two of the launchers were sent to Springfield Armory for examination and comment.[4] Army Ground Forces were exceedingly anxious to receive some of the 3.5-inch launchers for service field tests, and authorization for limited procurement by Industrial Service, OCO, was being rushed so that everything would be in readiness by 15 August 1945. Cheney Bigelow drawings with Ordnance drawing numbers assigned were to be used in the initial procurement.[5] On 7 August 1945, Headquarters, Army Service Forces, directed the Chief of Ordnance to initiate at once the procurement of 5,000

1. OCM Item 25110, 22 Aug 1944.
2. OCM Item 25517, 26 Oct 1944, approved OCM Item 25776, 16 Nov 1944.
3. O.O. 471.94/4753, ltr to Spring. Ord Dist, 11 Apr 1945.
4. Ltr to Spring. Armory, 22 Jun 1945; ltr to Spring. Ord Dist 22 Jun 1945; Memo, Res & Dev Sv to Small Arms Div, Ind Sv, 2 June 1945 and 1st Ind 29 Jun 1945.

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Launchers, Rocket, 3.5-inch, and requested early standardization of the T74 Rocket Launcher.[1]

The cancellations of V-J Day included the T74 Rocket Launcher requirements, after the completion of only 108 of the launchers.[2]

Even though there were no existing requirements, the development and testing of the launcher was practically complete prior to V-J Day, so it was found desirable to complete its standardization, in accordance with the findings of the Infantry Board that there existed a military requirement in the Infantry for a rocket and launcher of greater destructive effect against armor and emplacements than the 2.36-inch rocket and launcher, but of substantially equal portability, and that the T74 Rocket Launcher satisfactorily fulfilled the requirements.[3] Accordingly, Ordnance Committee took action shortly after V-J Day whereby the T74 was standardized as Launcher, Rocket, 3-5-inch, M20 (formerly T74)[4]. Springfield Armory had asked for instructions relative to preparation of specifications, drawings, packaging, instructions, etc., on the 3.5-inch Rocket Launcher. Immediately after V-J Day the Armory was authorized to proceed with the preparation of the Specification and revised drawings so as to be ready in case requirements for procurement should be re-established. [5]

When technical responsibility for rocket launchers was transferred from Springfield Armory to Rock Island Arsenal, all vellums, technical data, and pilot line tooling was sent to the Arsenal,[6] to be held awaiting a future decision on whether to proceed with the procurement of the more effective 3.5-inch M20 Rocket Launcher.

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1. 1st Ind, O.O. 471.94/5894(c); Memo, Special Weapons Br, SPOTS to Small Arms Div, Ind Sv, 9 Aug 1945, and 1st Ind, Fiscal Sec, Small Arms Div, Ind Sv, to Rifle & Hand Arms Br, 9 Aug 1945.
2. OCM Item 28797, Aug 20, 1945, Post V-J Day Research & Development Program Approved OCM Item 28847, 23 Aug 1945.
3. Infantry Board Report No. 1826, 16 Jul 1945.
4. OCM Item 29325, 11 Oct 1945, approved OCM Item 29749, 29 Nov 1945.
5. O. 471.94/266; Memo, Rifle & Hand Arms Br to Small Arms Div, 28 Aug 1945; O.O. 471.94/303; O.O. 471.94/146
6. TT, SPOIS to Springfield Armory, 10 Sep 1945.

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PAINT FOR ROCKET LAUNCHER T74

Trouble was encountered with the paint on Launcher, Rocket, 2.36-inch, M9E1 (M9A1), as the O. D. paint had insufficient adhesion to the metal and an excess of chipping and peeling occurred. [1]

In the tests on Launcher, Rocket, 3.5-inch, T74, it was suggested the use of Paladin black coating as a primer might increase the adhesion of the O. D. paint and improve its resistance to abrasion and rough usage. Therefore, Paladin was investigated and tested for use on both launchers.[2] After various tests, however, its use was not authorized, a conventional anodize, zinc chromate primer U.S.A. 3-201 and finish coat U.S.A. 3-173 being authorized.

CONCLUSION

Although V-J Day brought cancellation of Rocket Launcher contracts and a suspension of development projects, it was contemplated continuing launcher production on the M18 and M20 types in the future at Rock Island Arsenal when and if requirements might be established. In the meanwhile, the rocket launcher programs were to be held in abeyance. [3]

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1. TT 8 Mar 1945, SPOIS to Spring. Ord Dist, re ltr 1 Mar 1945 SPOEG 411.6/163
2. Memo, Res & Dev Sv to Small Arms Div, 9 Jun 1945; Memo, Hand Arms & Equip Br to Res & Dev Sv 28 Jun 1945.
3. OCM Item 28797, Aug 20, 1945, approved OCM Item 28847, Aug 23 1945; Memo for Record (Res & Dev Sv) 16 Oct 1945; Memo Rifle & Hand Arms Br, Small Arms Div, Ind Sv to Res & Dev Sv, 17 Oct 1945.

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PART III

ROCKET LAUNCHER CONTRACTS AND CONTRACT PRICES

The original contract with the General Electric Company, W-478-ORD-1862, dated 19 May 1942, called for production of 20,004 M1 Rocket Launchers at an estimated price of $27.44 each, which was derived from a study of the sample launcher submitted to the company during negotiations. After mass production had been accomplished, an order for 102,000 M1 Launchers was placed and formalized by contract W-478-ORD-2118, dated 12 September 1942. The contract price was established at $15.07. A reduction was made to $14,82 by virtue of an engineering change on the front grip. As previously mentioned, the M1 Web Sling was adopted for the M1 Launcher, which increased the price to $15.41. The muzzle deflector which was added to the M1 Rocket Launcher, as originally designed, came to $.84 each, and a later type cost $.575 each. Inasmuch as several engineering changes were enacted in the process of changing to the M1A1 Launcher, such as wire wrapping, change in the electrical contact in the firing mechanism, and addition of the muzzle deflector, some of the launchers on contract W-478-ORD-2118 were delivered without deflectors at $16.64, and the remaining portion were delivered with deflectors at $17.21 each.

Two contracts were placed during the year 1943: one, known as contract W-478-ORD-3979, dated 12 June 1943, called for production of 46,522 weapons; the other, known as contract W-19-059-ORD-370, dated 4 October 1943, called for production of 113,031 Rocket Launchers. The new type two-piece Rocket Launcher M9 was just coming into production. Only 4,187 units were delivered on the latter contract as M1A1 Launchers. The estimated price of the M9 was set at $47.70, which was based upon a study of test models. Because of

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numerous improvements and changes in design, coupled with the necessity of procuring some new manufacturing equipment, an obvious increase in price over the M1A1 was to be expected. After mass production of the M9 might be accomplished, then a definite price could be established. A total of 26,087 of the M9 Rocket Launchers on contract W-19-059-ORD-370 was delivered at $41.06, and 82,757 M9A1s were delivered at $34.02 each. An anal ysis of the above prices reveals that material cost of the Rocket Launcher was between $18.00 to $21.00, which made up about half of the total cost of the item. During the course of production the material costs were not greatly reduced, but such items as special tools, direct labor, and administration were steadily reduced as the program progressed.

With the placement of contract W-19-059-ORD-1273, dated 24 May 1944, a quantity of 121,013 of the M9A1 Launchers was slated for production at an estimated price of $33.21 per unit. The entire quantity was delivered at $30.39 each because of lower costs than originally estimated.

Contract W-19-059-ORD-2314, dated 16 December 1944, called for delivery of 57,818 of the M9A1 Rocket Launchers at an estimated price of $33.21 each. The actual costs were somewhat less than estimated, and the whole quantity was delivered at $31.06 each.

During June 1944, when negotiations were initiated with the Cheney Bigelow Wire Works, a sample M9A1 Rocket Launcher was submitted to that company for study. After analysis of the weapon a tentative quotation was submitted of $44.17 per item. Am order was subsequently placed with that company for 57,600 launchers with spare parts, which was formalized by contract W-19-059-ORD-1415, dated 26 June 1944. The undertaking of the

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contract involved procurement of considerable manufacturing equipment. Production was initiated in September 1944. After a study of actual costs of production, a supplemental price agreement was reached, which reduced the price per launcher from $44.17 to $37.34. A continuing contract, W-19-059-ORD-2791 was placed 14 March 1945, with initial price established at $35.00. That contract was amended to provide for the substitution of the new reflecting sight for the bar sight, thereby increasing the unit price to $48.37. However, before any production was had on this last contract, it was cancelled in its entirety on 8 May 1945.

General Electric Company was given a contract for the production of Launcher, Rocket, M18 (Contract W-19-059-ORD-2820 on 8 May 1945) for 34,001 at an initial price of $74.68, which contract was cancelled in its entirety on 31 August 1945.[1]

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1. See Appendix "A" - 4. Contracts; Appendix "D" - 2. Production Chronology - General Electric Co; Appendix "D" - 3 - Production Chronology - Cheney Bigelow Wire Works.

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INSPECTION OF ROCKET LAUNCHERS

Use of Contractors' Drawings and Inspection Equipment

The extremely high demand for rocket launchers in active theatres necessitated the immediate establishment of production lines, once the developed designs were approved by the Ordnance Committee. It was often necessary to place letter purchase orders on the basis of a description and a sample launcher, in order to have sufficient lead time with limiting items such as raw materials and machine tools. Contractor's detail drawings would be reviewed by Ordnance representatives as they were prepared, and were the basis on which the first launchers of the model were produced. Ordnance drawings would then be prepared and contracts supplemented to include them. However, by that time, production would already have been established and shipments made to the field. Contractors' gages and equipment were of necessity used on all initial production of the various types of launchers.

The salient features receiving 100 per cent inspection on all launchers were:

a. Bore diameter and straightness. - Commercial 2 1/2 inch tubing in 54 inch lengths were carefully watched for ellipticity. Projection welding, if not carefully controlled, was found to raise internal lumps. A broaching operation was necessary for a time to clean out such "pimples."

b. Electrical circuit.- For battery-operated rocket launchers, life of the circuit was tested with the indicator lamp in the stock, and by shorting at the tail latch, which, if "hot", would short out the indicator light. Twopiece launchers, with the single impulse generator, were checked

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with a sensitive current meter for minimum output.

c. Strength of welds was checked by frequent destructive test on welds from each welder. Outcroppings of bad welding were experienced several times and close control had to be exercised.

d. Contactor latch minimum travel insured that latches would reach sufficiently to contact the deepest tail groove of all 2.36 rockets.

e. On twopiece rocket launchers, the strength of the coupling joint was extremely important. Drop tests were periodically made and no distortion or misalignment of the two halves was permitted in that test, which simulated field abuse.

f. Sights were set and checked for zeroing adjustment for azimuth and elevation.

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PACKAGING OF ROCKET LAUNCHERS

Packaging for T1 Rocket Launchers

The original wood container for packaging of five (5) T-1 Rocket Launchers was developed and released on 17 June 1942 (Drawing Wood Container K-5409059). The gross shipping weight of that package was 117 pounds. Packing Instructions B-50, 917-4 was issued on 23 June 1942.

Packaging for M-1 Rocket Launchers.

It was found expedient to redesign the wood container so that eight (8) M1 Launchers could be packed in each container, thereby effecting a savings in gross shipping weight of 2.8 pounds per unit and a reduction in packing cost of .09 cents per unit. The new container was released for use as of 25 August 1942, the drawing therefor being K-5409060, Wood Container. The gross shipping weight amounted to 165 pounds. Amended packing instructions were issued 25 August 1942.

Packaging for M1A1 Rocket Launchers.

Because of the greater bulk of the wire-wrapped launchers, a change was made from eight launchers to six per box. The new container (Wood Container K-5409087) had a gross shipping weight of 132 pounds, which made a package more easily handled in the field. It was authorized for use as of 29 August 1943.

Packaging for M9 and M9A1 Rocket Launchers.

Ordnance Packaging Instructions PS No. 70, dated 15 May 1944, cover the packaging of the M9 and M9A1 Rocket Launchers. (Drawing K5409094, Wood Container).

Packaging for M9E2 (M18) Rocket Launchers (aluminum.)

A wood container for six M9E2 launchers was authorized on 2 April 1945 (Wood Box Drawing M-5413892) which was temporary packing for the first

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400 units shipped. It was contemplated a new packing box with insert changes, etc. would be required, as changes in the design of the(M18) M9E2 launcher were contemplated, prior to standardization, which would necessitate changes in the container. Quantity production not being had on that particular launcher, due to termination of contract, there was no further action in regard to packaging prior to the end of World War II.

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APPENDIX "A"

1. Army Supply Program Requirements for 2.36" Rocket Launchers.

2. Production of 2.36" Rocket Launchers.

3. Cumulative Chart of Requirements and Production.

4. Fixed Price Contracts and Prices for 2.36-Inch Rocket Launchers.

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ARMY SUPPLY PROGRAM REQUIREMENTS FOR 2.36" ROCKET LAUNCHERS

ITEM	DATE	REQUIREMENTS 1942	1943	1944	1945	1946
M1	Sep 1942	65,111	57,891	22,543		
M1	Feb 1943		64,584	73,028		
M1	May 1943		64,584	56,083		
M1A1	Jun 1943		96,601	98,101		
M1A1	Aug 1943		96,601	72,616	61,918	
M9	Feb 1944			115,845	98,612	
M9	May 1944			215,177	158,562	
M9	Aug 1944			215,177	171,516	
M9A1	Jan 1945				178,516	110,549
M9A1	May 1945				178,516	123,615
M9A1	May 1945				95,000	
M18						

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PRODUCTION OF 2.36" ROCKET LAUNCHERS

DATE	UNITS	CUMULATIVE		REMARKS
1942			***	General Electric Co. production
Jun	5,000		*	T1 (M1)
Jul	241	5,241	*	M1
Aug	7,768	13,009		
Sep	16,161	29,170		
Oct	13,137	42,307		
Nov	12,699	55,006		
Dec	12,422	67,428		
1943				
Jan	10,020	77,448		
Feb	7,692	85,140		
Mar	8,392	93,532		
Apr	8,234	101,766		
May	8,101	109,867		
Jun	4,596	114,463		
Jul	5,864	120,327		
Aug	13,262	133,589	*	Last production on M1 Total 112,790
Sep	10,758	144,347		
Oct	7,494	151,841		
Nov	7,062	158,903		
Dec	6,808	165,711		
1944				
Jan	6,020	171,731		
Feb	4,491	176,222	*	Last production on M1A1 Total 59,922
Mar	8,030	184,252		
Apr	13,050	197,302		
May	9,880	207,182		
Jun	17,382	224,564		
Jul	15,004	239,568	*	Last production on M9 Total 26,087
Aug	22,080	261,648		
Sep	29,227	290,875	***	Cheney Bigelow Wire Works began production
Oct	35,367	326,242		
Nov	30,000	356,242		
Dec	24,646	380,888		
1945				
Jan	23,000	403,888		
Feb	21,000	427,888		
Mar	19,742	444,630		
Apr	21,000	465,630		
May	10,997	476,627	*	Schedules canceled. Total production of M9A1 198,799

Grand Total of 2.36" Rocket Launcher Production 476,627

In addition to the above production, by authority of OCM Item 26147, Small Arms Division, Industrial Service, OCO, produced 500 M9E2 (M18) which were used for service tests and to establish methods of manufacture, prior to the standardization of the aluminum 2.36" Rocket Launcher as M18.

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FIXED PRICE CONTRACTS AND PRICES FOR 2.36-INCH ROCKET LAUNCHERS

1. GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT.

Launcher, Rocket, AT, M1.

Contract No.	Date	Quantity	Price
W-478-ORD-1862	19 May 1942	20,004	$27.44
W-478-ORD-2118	12 Sep 1942	102,000	

(1) Initial price established at.....15.07
(2) Due to engineering change on front grip unit price changed to.....14.82
(3) Due to addition of Slings, price increased to.....15.41
(4) Due to addition of Muzzle Deflectors:
(a) Early Muzzle Deflector cost.....$ .84 each
(b) Other Muzzle Deflector cost..... .575 each

*****

Launcher, Rocket, AT, 2.36", M1A1.

(5) Due to reinforcing of the launcher tube, and other engineering changes, part of the launchers on contract W-478-ORD-2118 were delivered as M1A1 Launchers as follows:
(a) Without Deflectors 16.64
(b) With Deflectors.....17.21

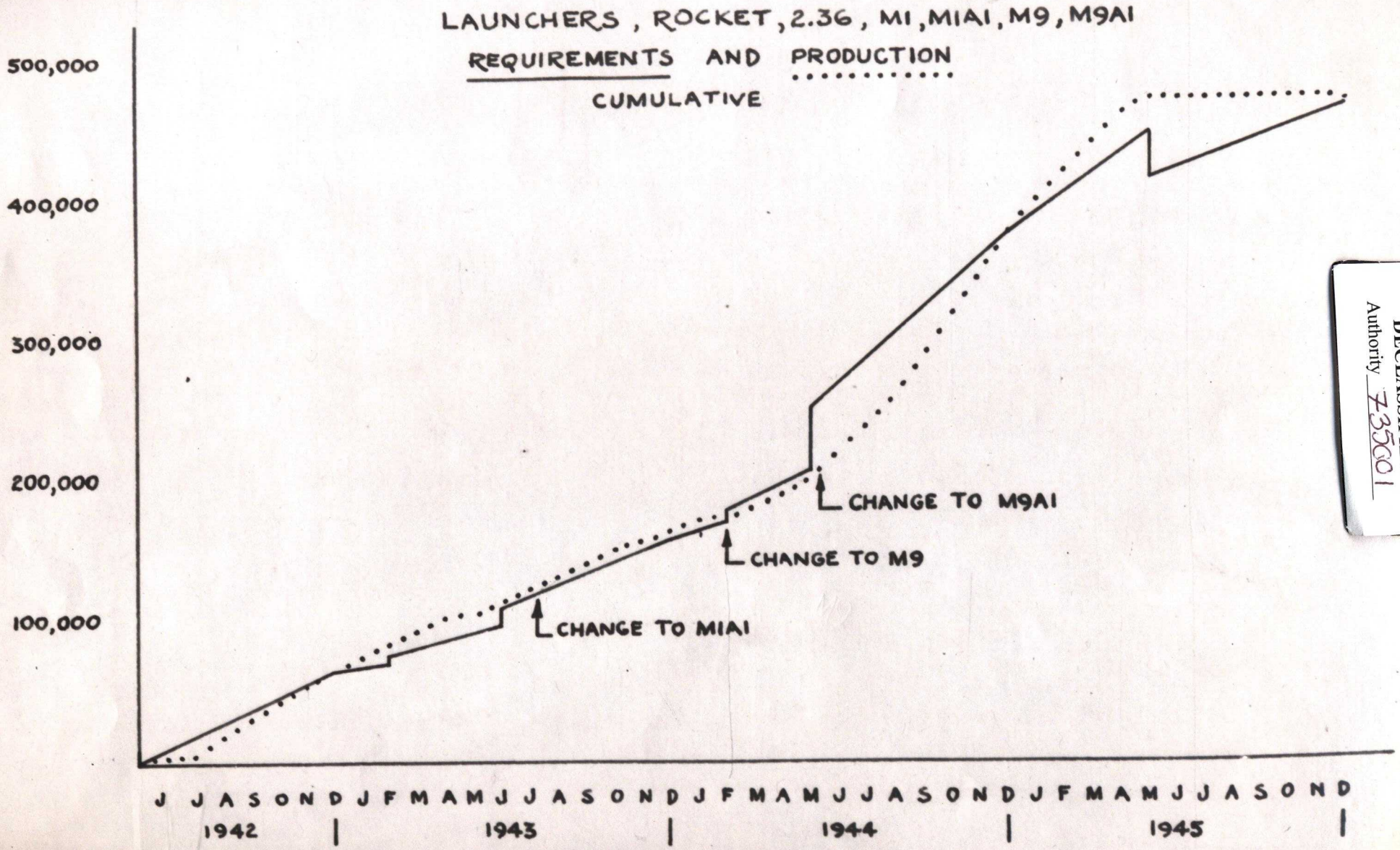
W-478-ORD-3979	12 Jun 1943	46,522	17.21
W-19-059-ORD-370	4 Oct 1943	113,031	

(1) Only 4,187 units were delivered at 17.21

*****

Launcher, Rocket, 2.36", M9 and M9A1.

(2) Due to radical changes in design the balance of launchers on Contract W-19-059-ORD-370 were delivered as M9 and M9A1 Launchers.
(3) Important changes in design in the M1A1 to make the M9 Launcher were as follows:
(a) Two-piece construction instead of one-piece construction.
(b) Impulse Generator substituted for battery electric system.
(c) Adjustable Bar Sight substituted for fixed sight.
(d) Change in center coupling. (for M9A1)
(4) Initial price for M9 Launcher established at 47.70
(5) Due to realization of lower costs than was initially expected:
(a) 26,087 M9 units delivered at.....41.06
(b) 82,757 M9A1 units delivered at 34.02


LAUNCHERS, ROCKET, 2.36, M1, M1A1, M9, M9A1
REQUIREMENTS AND PRODUCTION
CUMULATIVE
500,000
400,000
300,000
200,000
100,000
CHANGE TO M1A1
CHANGE TO M9
CHANGE TO M9A1
J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1942
1943
1944
1945

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(c) BREAKDOWN
CONTRACT W-19-059-ORD-370

	M9	M9A1
Material	$20.90	$18.72
Labor	3.34	2.25
Burden	5.34	3.90
Engineering & Tool Maint.	.94	.30
Special tools	1.19	.87
Contingency	0	1.30
Administration	3.81	3.28
Profit	5.54	3.40
Selling Price	$41.06	$34.02

*****

Launcher, Rocket, 2.36", M9A1.

Contract No.	Date	Quantity	Price
W-19-059-ORD-1273	24 May 1944	121,013	

(1) Initial price established at.....$33.21
(2) Due to lower costs, entire quantity delivered at.....30.39

BREAKDOWN
CONTRACT W-19-059-ORD-1273

	Initial price	Delivery price
Material	$18.72	$18.19
Labor	2.25	1.77
Burden	3.90	2.84
Engineering	.55	.67
Contingency	1.27	---
Gen. & Adm.	3.20	2.82
Profit	3.32	4.10
Selling Price	$33.21	$30.39

W-19-059-ORD-2314 16 Dec 1944 28,603

(1) Initial price established for 57,818 units at.....$33.21
(2) Price for entire quantity subsequenty reduced due to realization of lower costs.....31.06

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Launcher, Rocket, 2.36", M9E2

Contract No.	Date	Quantity	Price
W-19-059-ORD-2225	30 Nov 1944	500	

(1) Limited procurement of Rocket Launcher similar to M9A1. Significant changes in design include:
   (a) Substitution of aluminum construction in place of steel.
   (b) Substitution of Sight, Reflecting, Assembly, instead of Sight, Bar, Assembly.
(2) Initial price established at.....$122.74
(3) Several mandatory changes increased price to..... 156.73
   (a) Changes included: rubber eye shield on sight assembly.
   (b) Change in location of stock.
   (c) Change in design of sight assembly to allow for the rubber eye shield.

NOTE: Some indication of the increase in price of lb is reflected in contracts which have been placed for Sight, Reflecting, Assembly, to be used for field modification, with the following Contractors:

Contractor	Contract No.	Quantity	Unit Price
Greist Mfg Co.	W-19-059-ORD-2087	56,957	
(1) Initial price established at(for 125,000).....			$15.14
(2) PPA per PR 360.2, decreased price to.....			14.50
General Elec Co.	W-19-059-ORD-2088	106,130	16.00

*****

Launcher, Rocket, 2.36-Inch, M18 (M9E2)

Contract No.	Date	Quantity	Price
W-19-059-ORD-2820	8 May 1945	0	

(1) This is the M9E2 standardized with slight modification in sight bracket and stock assembly.
(2) Initial price was established at (for 34,001).....$74.68
(3) Contract cancelled in its entirety 31 August 1945.

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2. CHENEY BIGELOW WIRE WORKS, SPRINGFIELD, MASSACHUSETTS.

Launcher, Rocket, 2.36", M9A1.

Contract No.	Date	Quantity	Price
W-19-059-ORD-1415	22 Jun 1944	45,455	
(1) Initial price established at (for 57,600).....			$44.17
(2) Due to redetermination of price under PR 341.1 reduced to.....			37.34
W-19-059-ORD-2791	14 Mar 1945	0	
(1) Initial price established at.....			35.00
(2) Due to substitution of Sight, Reflecting, Assembly, D7161556 for Sight, Bar, Assembly, C7311814, unit price increased to.....			48.37
(3) Contract cancelled in its entirety 8 May 1945.			

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APPENDIX "B"

1. Photographs of Launcher, Rocket, AT, T1.
2. Photographs of Launcher, Rocket, AT, M1.
3. Photographis of Launcher, Rocket, AT, 2.36", M1A1.
4. Photographs of Launcher, Rocket, 2.36", M9.
5. Photographss of Launcher, Rocket, 2.36", M9A1.
6. Photographs of Launcher, Rocket, 2.36-Inch, M18.

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APPENDIX "B" - 1

1. Rocket Grenade Launcher T1, showing Rocket Grenade T1 in relative position.

2. Firing position for Rocket Grenade Launcher T1 in tube.

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APPENDIX "B"-2

1. Launcher, Rocket, AT, M1

2. (a) Aiming of Launcher
   (b) Range of Sights
   (c) View of Target thru Sights

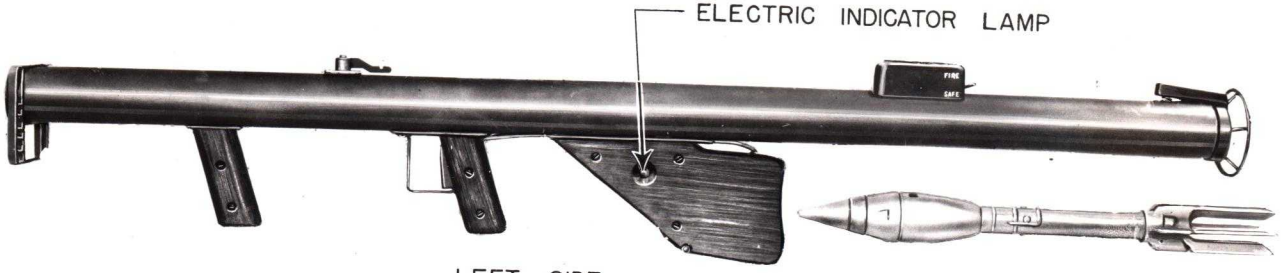
3. Position for Firing - Standing

4. Loading

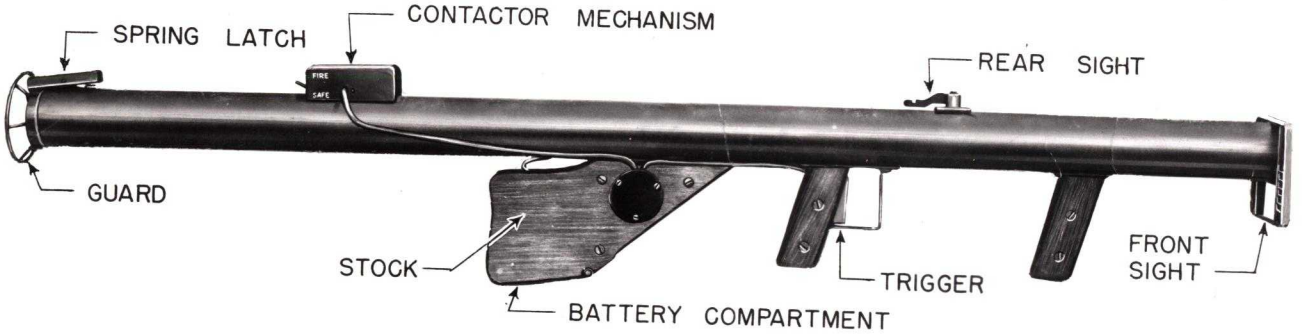
5. Position for Firing - Kneeling

6. Position for Firing - Seated

7. Position for Firing - Prone



LEFT SIDE



RAPD 24024

RIGHT SIDE

LAUNCHER, ROCKET, AT, M1

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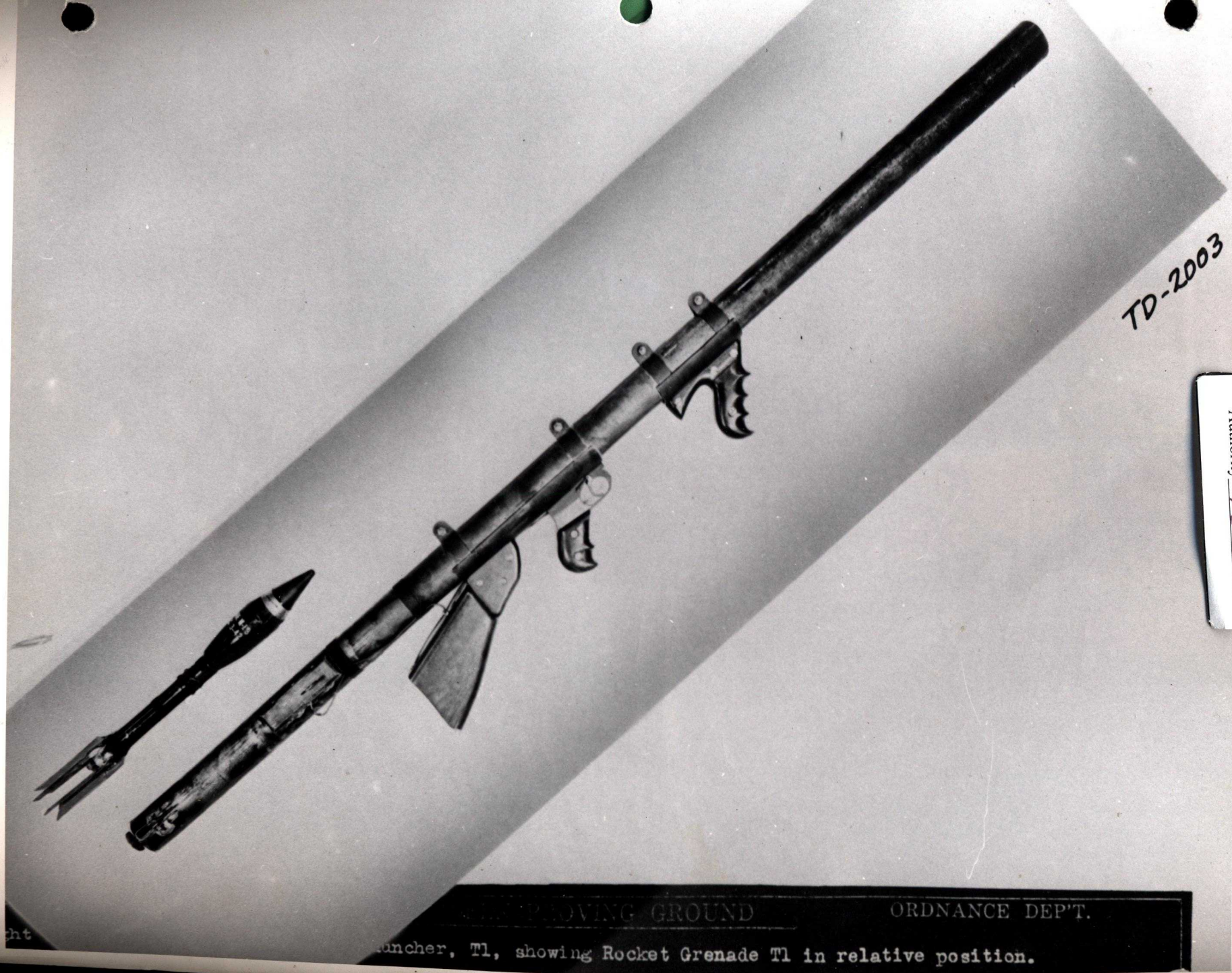

TD-2003

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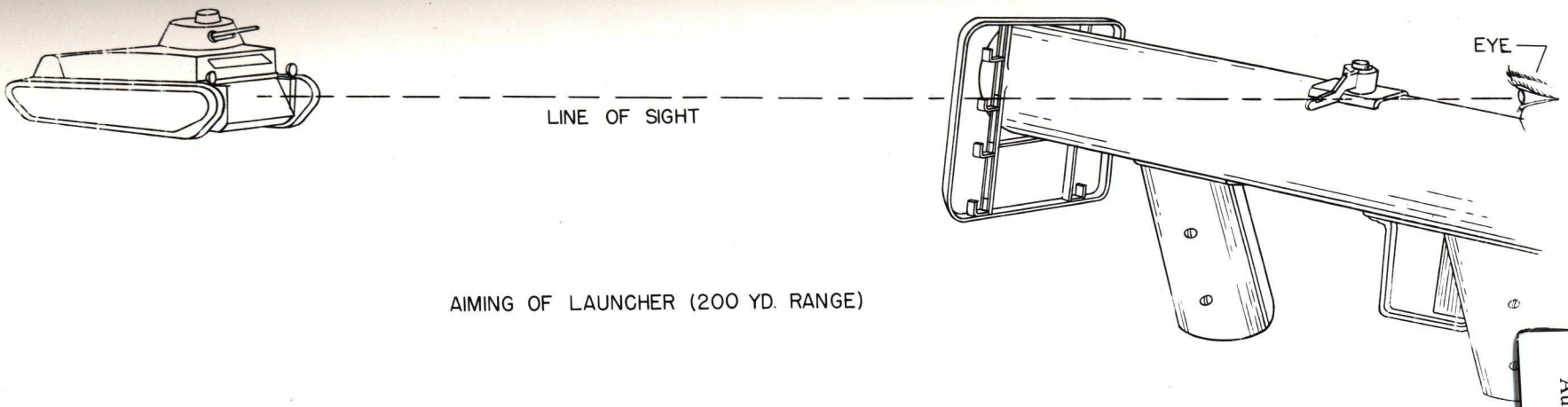
...ROVING GROUND ORDNANCE DEP'T.

...uncher, T1, showing Rocket Grenade T1 in relative position.



AIMING OF LAUNCHER (200 YD. RANGE)

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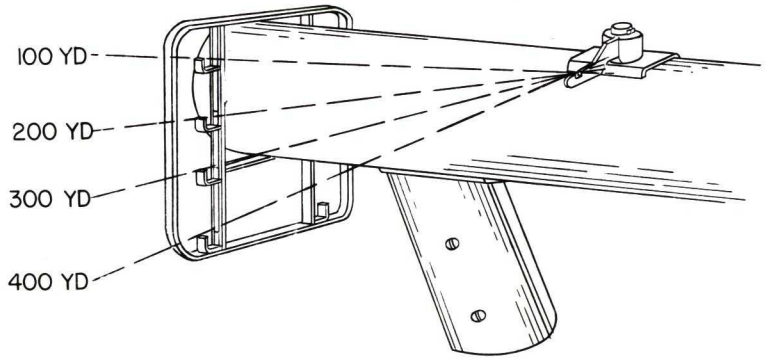
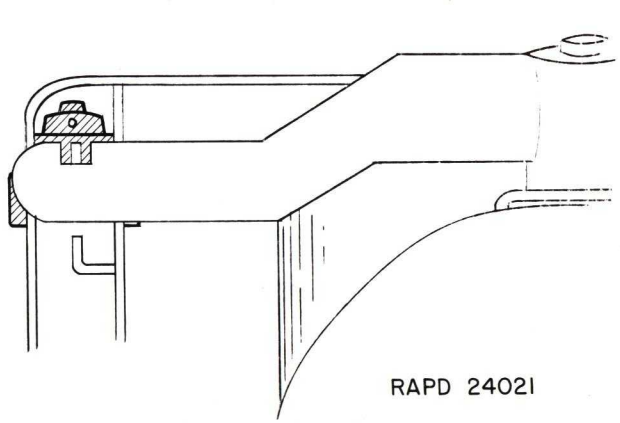


RANGE OF SIGHTS



RAPD 24021

VIEW OF TARGET THRU SIGHTS

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POSITION FOR FIRING - STANDING

64659 6-1-42 | ABERDEEN PROVING GROUND | ORDNANCE DEP'T.

Firing position for Rocket Grenade Launcher T1 with Rocket Grenade T1 in [redacted]e.

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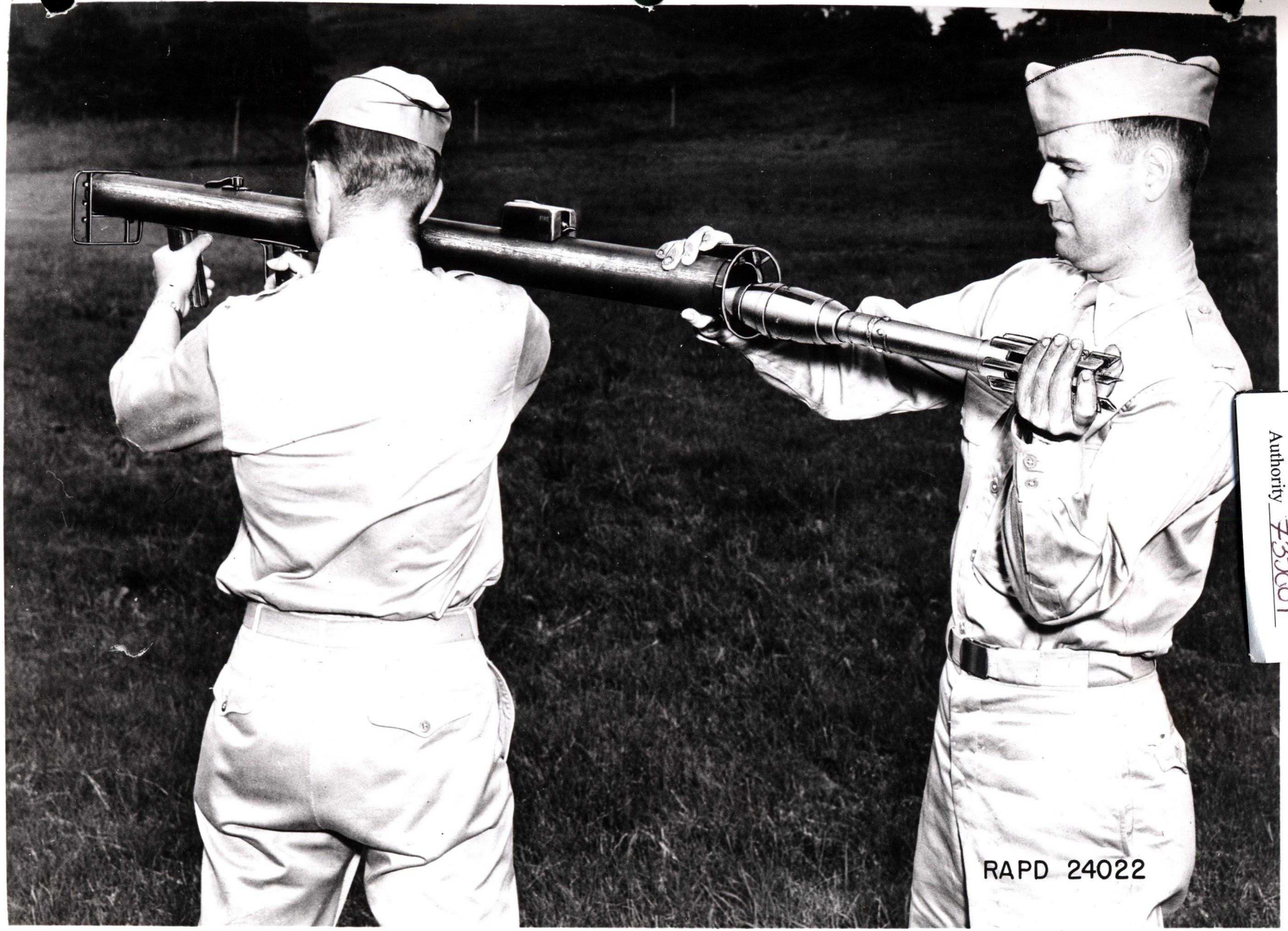

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DECLASSIFIED
Authority 73500

DECLASSIFIED
Authority 735001

DECLASSIFIED
Authority 735001

APPENDIX "B" - 3

1. Rocket Launcher, M1A1

2. Rocket Launcher, M1A1 - Left Side View

3. 2.36 inch Rocket Launcher M1A1 - Limited Standard

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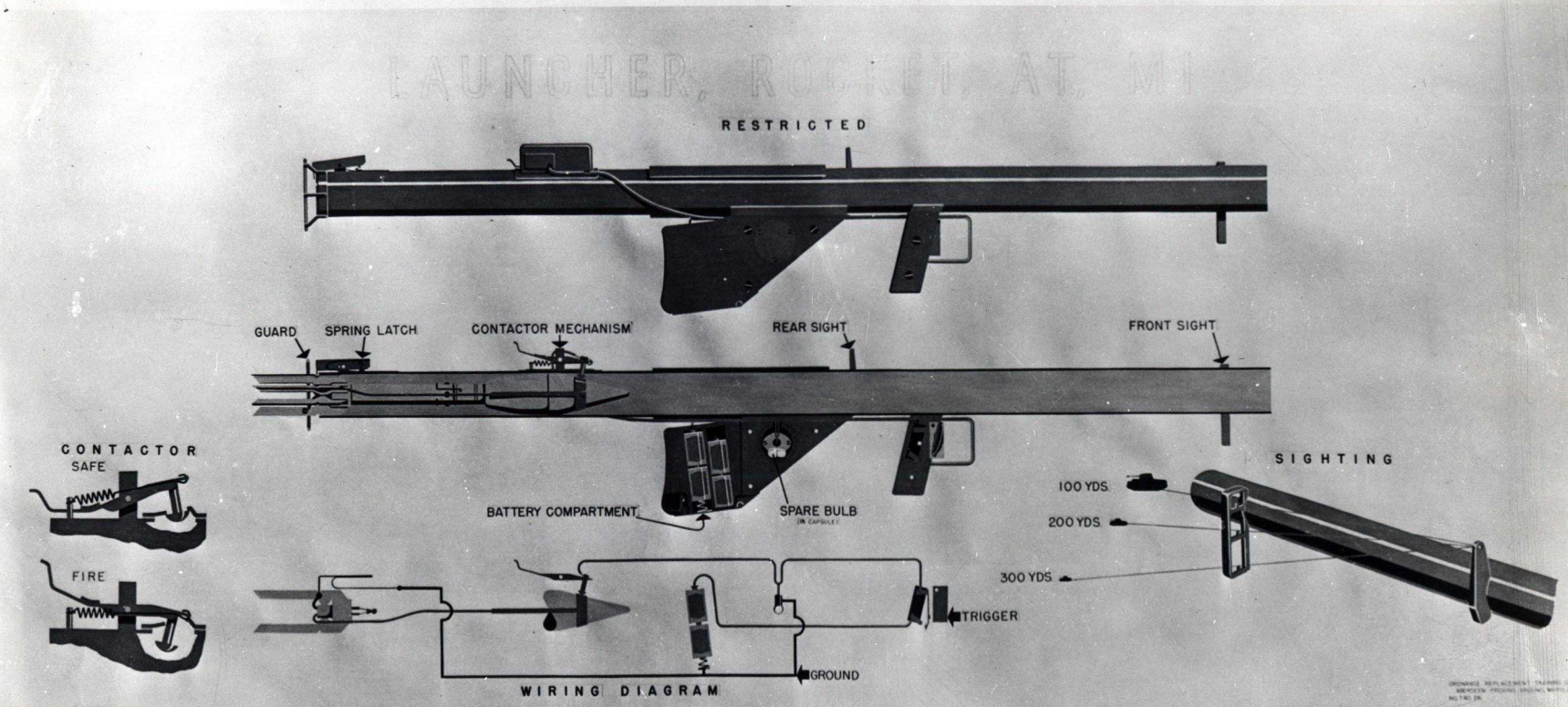

ROCKET LAUNCHER
MIAI

ORD.19435

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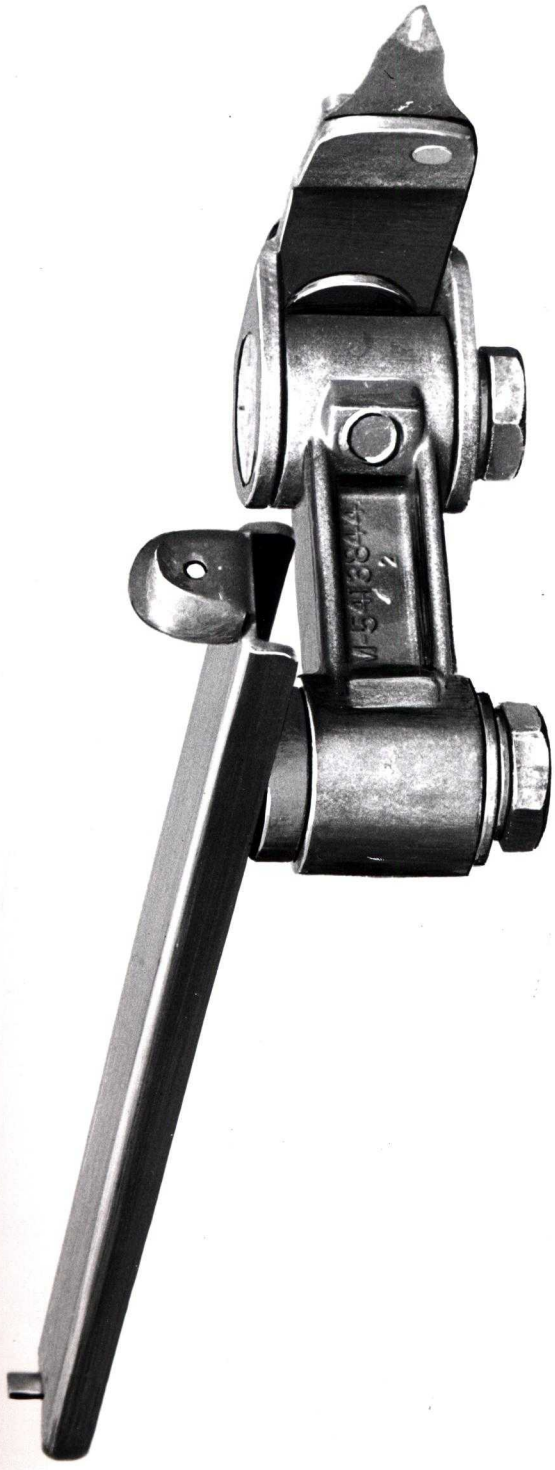
200953

DECLASSIFIED
Authority 735001

R0953

DECLASSIFIED
Authority 735001



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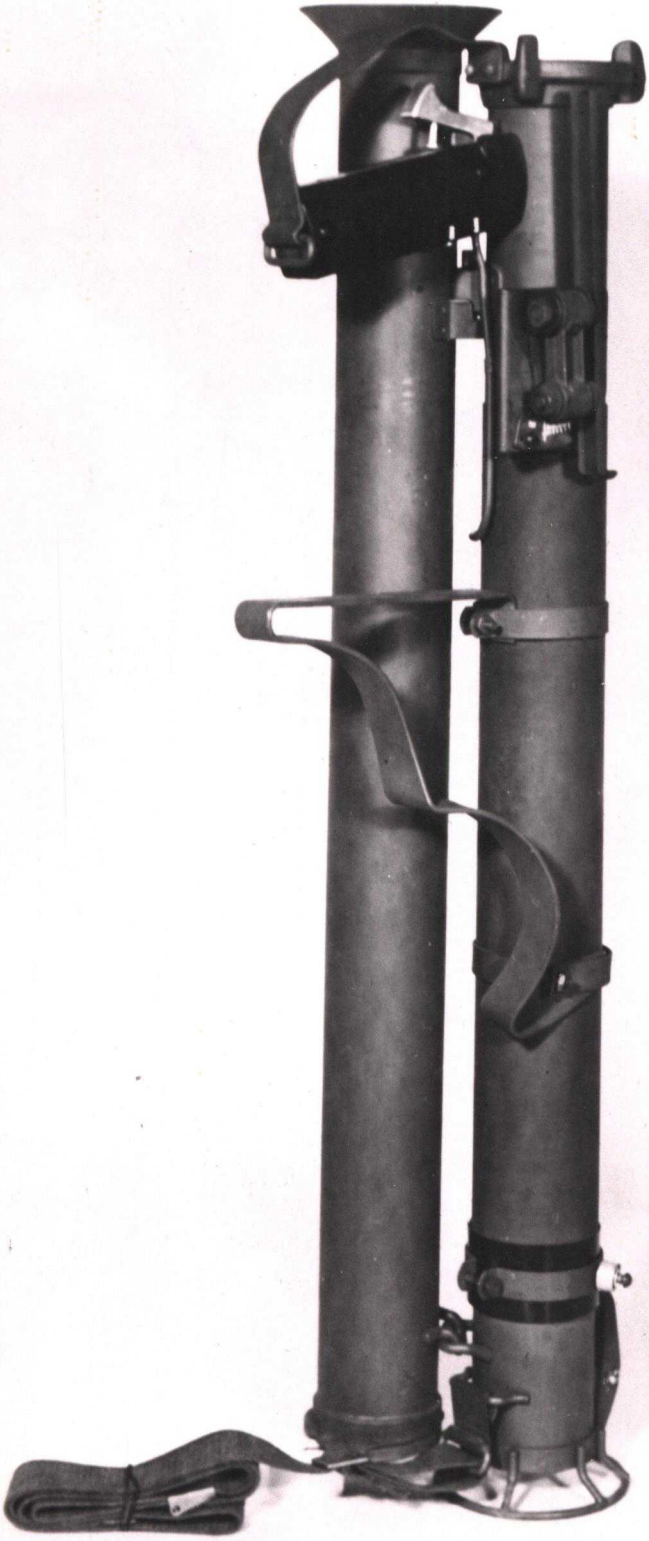

Historical Data

Cheney Bigelow
Wire Works
Rocket Launcher M9A1

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T-74 3.5"
Launcher

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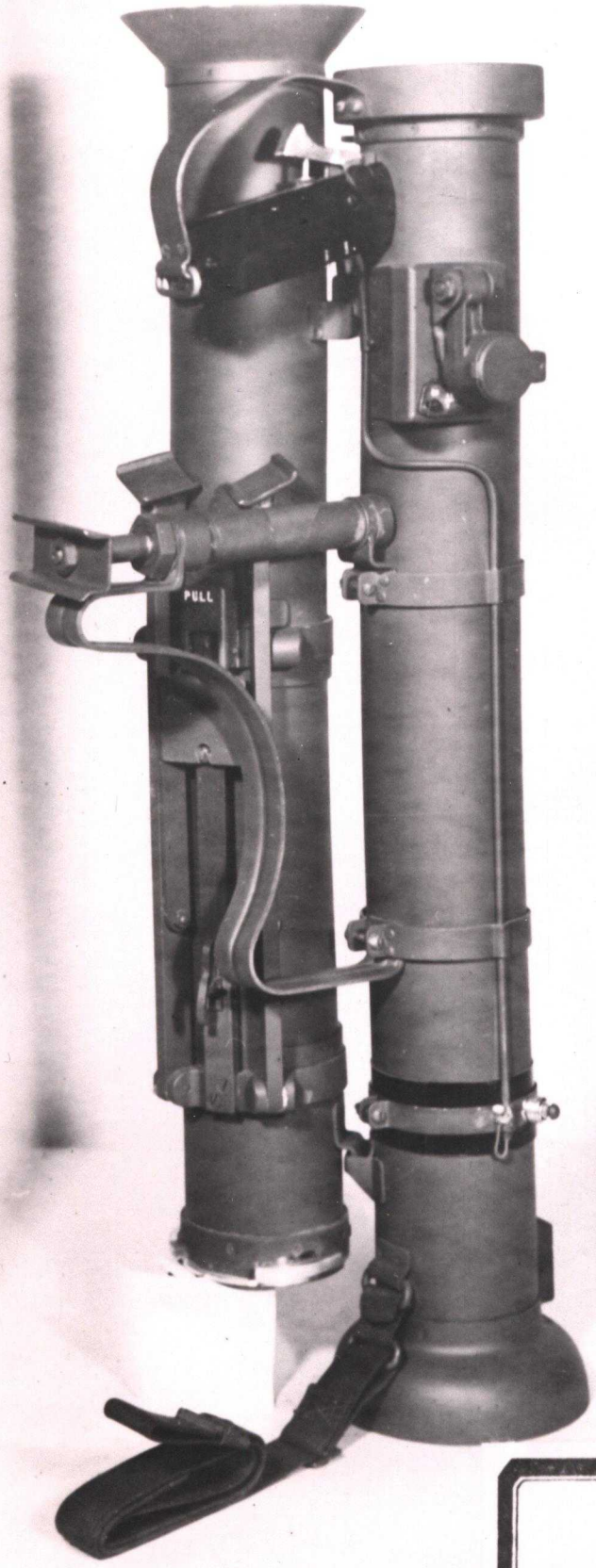

T-74 3.5"
Launcher